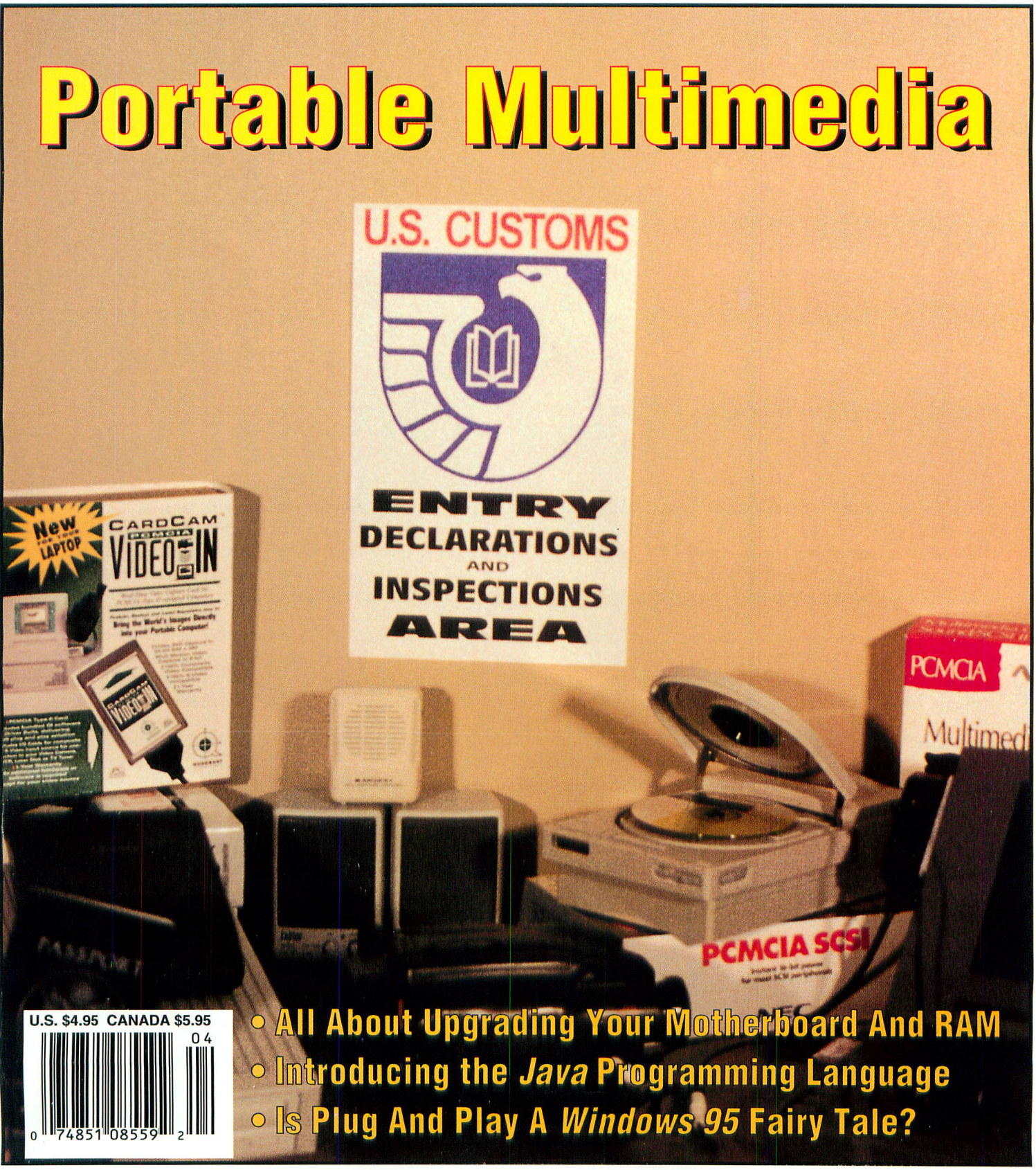
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March/April 1996

Portable Multimedia



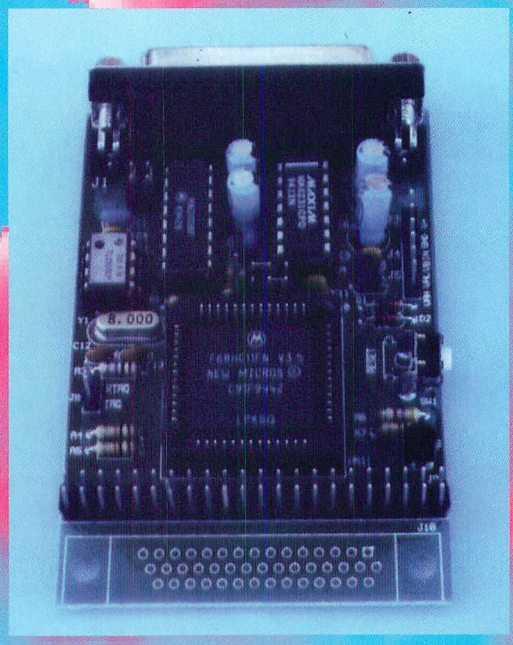
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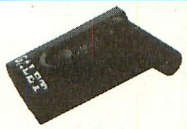
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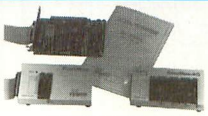
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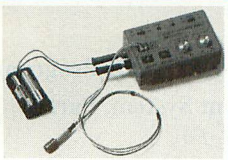


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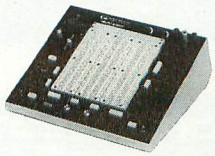
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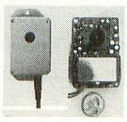


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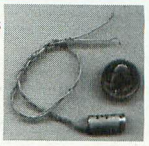


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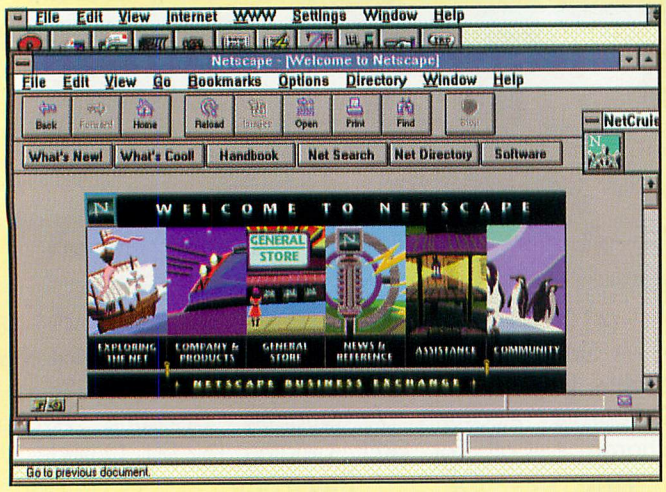
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Cover Photo By Tom Benford

In This Issue

Until very recently, portable-computer users had to make do with just basic laptop computing applications due to a lack of products needed to make their PCs into multimedia machines. This has recently changed dramatically, as you'll learn from Tom Benford's review of powerful portable peripherals for the road in "Multimedia To Go" beginning on page 47. You can see some of the products in action in the cover photo. They give desktop multimedia a run for its money.

As time marches inexorably on, so does the need to keep up with the latest changes in personal computing. The computer on which you spent so much money two years or so ago just won't cut it with today's hot new operating systems and applications software. If you're feeling the crunch, it's time to upgrade. To help you do this, Joe Desposito offers "All About Motherboards and RAM," in which he guides you along the upgrade trail with important information you need to make intelligent decisions. The story begins on page 12 and includes helpful advice on selecting a replacement motherboard and unravels the mysteries surrounding RAM. This article has lots of helpful "buyer's guide" tables.

If you haven't heard about it yet, the *Java* programming language has the potential for changing how you work at your computer and surf the Internet. On page 20, Hardin Brothers introduces you to this phenomenon, tells you about its background, describes how it can change the personal-computing scene and gives you some idea where it's likely to go.

In "Plug and Play: Is It a *Windows 95* Fairy Tale?," beginning on page 34, TJ Byers discusses what it really costs to set up and use Microsoft's implementation of this user-relief procedure. You'll learn about the benefits of PnP, legacy cards, the Hardware Installation Wizard, BIOS upgrades and more.

Tom Fox returns with his series on "A 68HC11 EEPROM Programmer/Mini-Development System" on page 27. In Part 3, he details how to build an MCU-based solid-state wind vane. Then on page 39, as a follow-up to his article in the last issue of *MicroComputer Journal*, Fred Eady introduces you to "Development Software for the MMT-188EB Microprocessor Board." Fred leads off with some basic microcomputer theory and 80188 architecture details and then plunges into details on using some really powerful software tools you can use to implement your home-grown projects.

Where do you turn for technical electronic information you need? If you answered "the Internet," you get a gold star. "In Fast and Easy Access to Free Technical Data On-Line," beginning on page 56, Jan Axelson details what's available on the Internet and how you can get what you need from the World Wide Web. To help you navigate the Internet byways, Jan serves up tips for searching out what you need. She also discusses other on-line sources and other new ways to get data.

With all the exposure Microsoft's *Windows 95* has been getting lately, it's easy to lose sight of alternative operating systems that are available to the PC user. To remedy this situation, Steven Sweet offers "IBM's *OS/2 Warp* Version 3.0," in which he discusses this new and improved 32-bit operating system for the masses. Beginning on page 63, Steve discusses what you need, pre-installation decisions you must make, installation procedures and lots more regarding this mature, robust OS.

Editorial By Art Salsberg

Falling Short

Daily news about the Internet is inescapable. It's hot! But is it really that good? My answer is no at this time. It has a lot of shortcomings for many people, especially the mass-market general user. Everyone is rushing to have a presence on the Internet. It seems that it has become a status symbol more than anything else.

If you've surfed the Internet as a home user with a basic modem, say, 14.4K- or even 28.8K-bps capability, you begin to wince as it takes minutes to bring up a "home page" on your video monitor's screen. Before the public recognized the diversity of the Internet, corporations and universities were the initial communicators and browsers, using wide-bandwidth lines that made connections in the wink of an eye.

New sites and even existing ones have lots of problems. You've got to crawl around the Internet for a long time to find meaningful information among the garbage. Much of the information appears to be short promotional offerings—you know, home pages with very glamorous graphics and marketing information, minus useful details.

The foregoing was confirmed recently in a study by the Gartner Group, which reported that 90% of companies performing business on the World Wide Web aren't meeting the needs of customers. Corporation descriptions, ordering details, annual reports and the like don't cut it. What's desired are technical fixes, interactive technical support, applications data, etc.

At this time, the Internet is in its early growing stages. It's moving fast and advances in content and operation are sure to burgeon. What was fine for academic and research purposes, isn't at all satisfactory for enthusiastic home PC explorers, who spend long, long hours regularly trying to mine the Net for something worthwhile.

A major battle for dominance on the Net has already started. Microsoft has joined with Sun Microsystems to use an Internet programming language, Java. A key to making the Internet more friendly is virtual-reality modeling, which lets programmers add three-dimensional modeling to files and programs.

Most Internet users enter it through one of the on-line service companies, such as AOL, CompuServe, Genie, *et al.* You need only a computer, modem, telecommunications programs and an account to get connected. For direct Internet service, you'll need an SLIP and PPP connection, rather than terminal emulation. This permits you to use graphical interfaces. However, it's more costly, say, $25 for a setup and $20 per month for the first 50 hours of use.

I liken the Internet to the early days of personal computing. In the computer field, however, we all know that things move at breathtaking speed. Before you know it, it's Pentium time.

With all the money and talent being thrown at the Internet, the prospects of even making money through it, I anticipate that it will be among the most-successful adjuncts to personal computing that one can imagine in only a few years. There's much more to it than being able to order a Pizza on-line. So stick with it through its frenetic meanderings.



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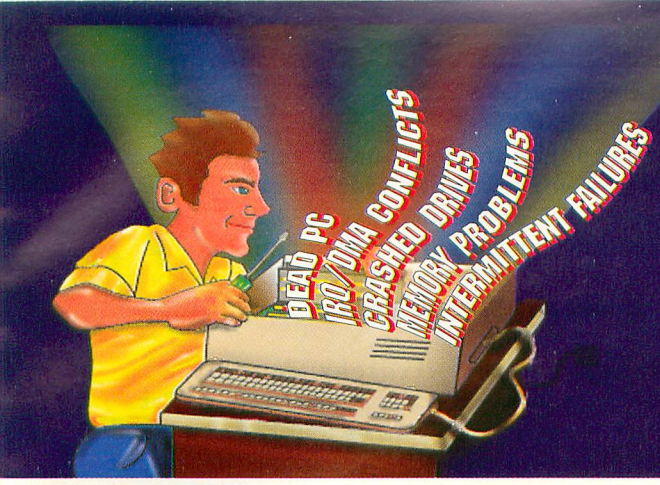
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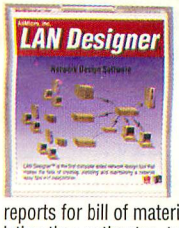
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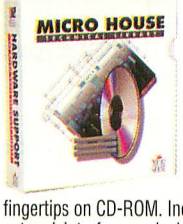
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CIRCLE NO. 101 ON FREE INFORMATION CARD

WIRELESS DOINGS. Motorola's new "MagicPipe" software technology uses messages to communicate between applications across wireless networks. Messages carry information and action requests between components on the same devices and across wireless networks. The operating environment also provides a transparent interface to many wireless communication networks, such as Motorola's Private DataTAC and IDEN-based networks, ARDIS, RAM Mobile Data and CDPD-based systems. For more information, call 1-800-247-2346.

IBM and Southwestern Bell Mobile Systems demonstrated a new wireless gateway service that makes it easier and faster to send and receive data, faxes and other information via cellular and telephone networks. The service enables customers to dial-up switched-data applications using a cellular telephone and a laptop computer without requiring special network configurations. Computers can work with existing communications software, also simplifying access to a variety of on-line services, such as the Internet. A company spokesman stated that it's expected to bring the benefits of wireless to those people who need data while on the go. The companies launched a trial in Chicago. Commercial deployment is expected to take place early in 1996.

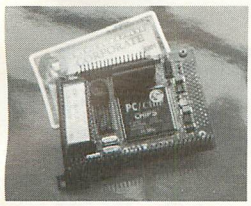
3D AUDIO. Three-dimensional audio performance appears to be on the horizon through a new alliance between Yamaha Systems and QSound Labs. Sound-placement technology is expected to provide superior hardware/software localization for use with Windows software. Traditional PC and stereo playback equipment is all that's said to be needed.

NEW MICROCHIP TECHNOLOGY. Microchip Technology, a leading supplier of eight-bit microcontrollers, introduced a bevy of new products. Among them is its PICMASTER-17B Universal In-Circuit Emulator System. This sophisticated development system provides real-time in-circuit emulation for Microchip's popular PIC17C4X microcontroller family. It operates on IBM/compatible PCs under Microsoft Windows.... It also debuted a powerful 28-pin eight-bit microcontroller with analog-to-digital converter, the PIC16C72. The EPROM-based device provides low-power advanced analog features, including ADC, brown-out detect peripheral and pulse-width modulation. Core of the device is an advanced RISC processor that features 200-ns micro-cycle times and only 35 powerful single-cycle instructions, each 14 bits wide. Typical applications include battery chargers, motor controllers, pointing devices, windshield-wiper controllers and automotive alarms.

SERVICE ASSOCIATION MERGER TALK. The National Electronics Service Dealers Association (NESDA) and the United Servicers Association (USA) Inc. started discussions on unifying into a single association. The Professional Servicers Organization of California agreed with the unification efforts and offered its assistance. Both NESDA and USA Inc. invite other national trade associations to become part of the unification dialogue. Suggestions on the unification process are welcomed by NESDA (tel.: 817-921-9061) and USA (tel.: 708-968-6752).

MOTOROLA DEBUTS NEW MICROCONTROLLERS. Motorola's Advanced Microcontroller Div. introduced the 68HC11E20 and 68HC11ED0, derivatives in its 68HC11 family of 8-bit microcontrollers. The 68HC11E20 (E20) is pin-compatible with the widely used 68HC11E9, but has additional ROM and RAM. The ED0 is a cost-effective member of the 68HC11 family that is pin-compatible with the 68HC11D0 that is optimized for applications making use of expanded-bus systems.

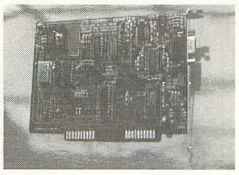
MULTIMEDIA GETTING HOTTER! Multimedia computers were expected to be the hottest-selling computer product this past holiday season when the returns are in, if responses to a recent survey of 200 computer retailers by the Consumer Electronics Manufacturers Association. Survey respondents say they expect big increases in unit sales, as follows: Multimedia PCs, 23%; "Edutainment" Software, 22%; RAM, 20%; PC Gaming Software, 20%; Printers, 17%; Modems, 16%; CD-ROM drives, 16%; Hard Drives, 16%; Notebook Computers, 11%; Computer Speakers, 11%; Word Processors, Spreadsheets and Database Programs, 8%. A shortage of Multimedia PCs is expected by 30% of retailers.



GCAT

World's Smallest PC?

3.4" x 2.6" 14MHz AT with 1Mbyte DRAM. Onboard CRT/LCD drive, Vee generator, speaker, with a PCMCIA Type I socket in the same profile! Optional PCMCIA Type II and III adapters for 130 Mbyte harddrives. Low power and sleep modes. Program in C, use your favorite compiler. Your PC compatible software boots from ROM. **$699!**



ICA90

I²C Adapter for PC's

Finally - find out what's happening on your I²C bus with this ISA half-card for your PC. Monitor, control or program I²C devices. There's even a low volt version for programming 3V I²C ic's. TurboBasic and C software libraries provided. This is the industry-standard board used worldwide. **$299!**

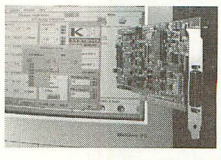
3V interface version **$399!**



OR5

1W DC-DC

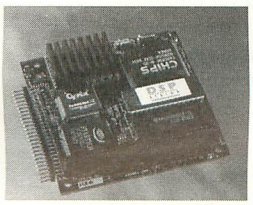
Ideal power converter for battery-powered systems. Input above or below o/p @ 3 - 15V in 3.3/5/6/9/12V out **$49!**



K16/PC

16-bit Windows datalogging!

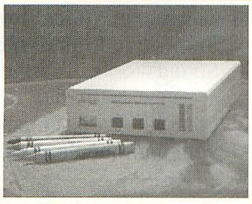
Now! A fast (5ksamples/sec) Windows PC card takes 8ch 16 bit data and displays it as a Virtual Multi-meter and stores data in an Excel file. Isolated analog inputs. **$399!**



TC486-50

Embed PC/104 cards easily!

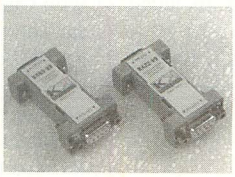
Choose from low-power TB8680 high integration board to TC486-50 fast 50MHz board. Simple development with TCPAK Developer's Pack: adds floppy drive, std. PC connectors or even a 130 Mbyte harddrive. From **$544!**



PPC

RS232 data modifier.

The Programmable Protocol Converter lets you change RS232 data "on the fly" to make incompatible devices talk to each other. String search/replace, add stop or data bits, etc. Easy to program in C, Pascal or Basic. **$699!**



K422/485

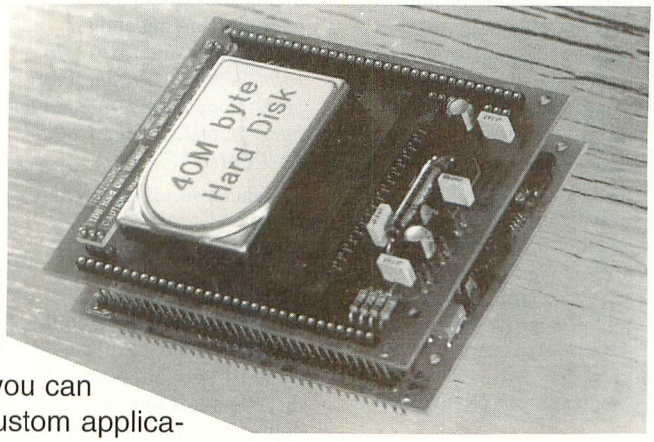
Low cost serial data converters.

Plug directly into your PC's COM port and drive RS422 or RS485 devices without any external power at up to 115kbaud. **$69!**

Isolated version **$139!**

TDS2020

FORTH CONTROLLER/DATALOGGER



This 4" x 3" low-power board now comes with easy-to-use ANSI-standard FORTH, a great high-level language for control and datalogging! Lots of ready-made software comes with the Starter Pack($499), so you can mix-and-match your own custom software to make a custom application in DAYS instead of months. Load onto the TDS2020 and boot up directly into your program.

Screams along at 20 MHz but runs on 30ma, 300µa sleeping. Onboard FORTH - no need for in-circuit emulation debug subroutines as you go! It's simple to attach keyboard, lcd, PCMCIA cards. 33 I/O lines, 2 x RS232 ports, I2C port, interrupts, pre-emptive multitasking, watchdog timer, on-chip 8ch 10-bit A/D, RTC. Program with PC! Store data on PCMCIA cards or 40 Mbyte miniature harddrive. 1000's in use worldwide for machine control, datalogging, inspection, factory automation, robotics, etc.

TDS2020 **$199!** (100s)

Saelig Company

European Technology

1193 Moseley Road, Victor, NY 14564
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call for details!

Hardware

Cyrix 586 PC

Micro Express' MicroFLEX-586 family of PCs are Cyrix 586-based 100-MHz PCs that

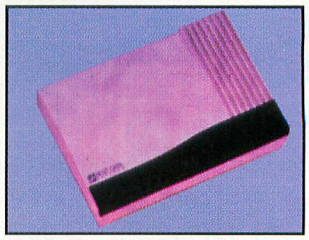


are available in both PCI and VL local-bus versions. The PCI version features the Phoenix PnP Flash BIOS. Included with the system are a 15" SVGA video monitor, 16M of RAM, 2x CD-ROM drive, and 850M hard drive. $1,799. *Micro Express, 1801 Carnegie Ave., Santa Ana, CA 92705; tel.: 714-852-1400; fax: 714-852-1225.*

CIRCLE NO. 1 ON FREE CARD

New Voice Modems

The new LX series of voice/data/fax modems from Best Data Products feature a compact design and customizable voice-mail system. The Smart One 2834VLX includes a 28.8K-bps modem, while the 1442VLX has a 14.4K-bps modem. The modems ship with Cheyenne's voice/data/fax software. $319/$189. 28/14. *Best Data Products, Inc., 21800 Nordhoff St., Chatsworth, CA 91311; tel.: 818-773-9600; fax: 818-773-9619.*



CIRCLE NO. 2 ON FREE CARD

Multimedia Subwoofer

The SoundWorks Powered Subwoofer from Cambridge SoundWorks is designed to enhance the quality and sound of speakers that come bundled with multimedia computers. A



supplied Y connector lets you connect the subwoofer to the same audio output that feeds the computer system's main speakers. The shoe-box-sized unit reproduces only non-directional frequencies below 150 Hz and contains a three-channel power amplifier and electronic crossover. $149.99. *Cambridge SoundWorks, Inc., 311 Needham St., Newton, MA 02164; tel.: 800-367-4434; fax: 617-244-3743.*

CIRCLE NO. 3 ON FREE CARD

PCMCIA

PCMCIA Encryption

SCM Microsystems' SwapCrypt Type II PC Card encrypts data files and directories. The device secures data with a technique that utilizes the One Time Pad (OTP) encryption method. It also protects data by using five-character passwords for each differ- ent data file or directory encrypted. Included in the package is a floppy disk for initialization of the encryption key and for backup. $99. *SCM Microsystems, 131 Albright Way, Los Gatos, CA 95030; tel.: 408-370-4888; fax: 408-370-4880.*

CIRCLE NO. 5 ON FREE CARD

PCMCIA Modem/Fax/LAN

Motorola's Marquis multifunction Type II PC Card combines a 28.8K-bps V.34 modem with 10Base-T Ethernet capability. The LAN



adapter employs a special architecture that saves transmission time by providing back-to-back packet handling, with no CPU intervention. The card also contains an integrated SNMP management system to the desktop level and on-line, context-sensitive diagnostics. Included is software for sending and receiving data and faxes. *Motorola, PCMCIA Products Div., 50 E. Commerce Dr., Schaumburg, IL 60173; tel.: 1-800-4A-PCMCIA.*

CIRCLE NO. 6 ON FREE CARD

PCMCIA Hard Drive

Simple Technology's 260M Hardrive is a hard disk in a Type III PC Card format. The drive features low-power circuitry, over 750 Gs of non-operating shock resistance and a rating of over 300,000 start/stop cycles. $499. *Simple Technology, Inc., 3001 Daimler St., Santa Ana, CA 92705; tel.: 714-476-1180; fax: 714-476-1209.*

CIRCLE NO. 7 ON FREE CARD

PCMCIA Diagnostics

The PC ReportCard and PC ExtenderCard from Accurite Technologies are PCMCIA development and test cards. By using the PC ReportCard PC Card-size diagnostic card in conjunction with the PC ExtenderCard, all the PC Card I/O and memory-access cycles are displayed via a series of LEDs, which allows for quick diagnosis of the card's hardware or software.

The PC ReportCard's external trigger signal can be connected to an oscilloscope or



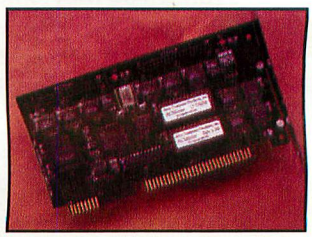
logic analyzer to aid with capture of all timing cycles. The card also contains a general-purpose logic probe that can be used to view bus signals or signals on the PC Card under test.

The PC ExtenderCard features test points for each of the 68 pins of the PCMCIA bus, with clearly labeled mnemonics for each point. It also includes 16 DIP switches that permit breaking of key signals to the PC Card under test to isolate problems. $229 each. *Accurite Technologies, Inc., 231 Charcot Ave., San Jose, CA 95131; tel.: 408-433-1980; fax: 408-433-1716.*

CIRCLE NO. 8 ON FREE CARD

Mirroring IDE Adapter

AC-Mirror from ARCO Computer Products is a RAID 1



mirroring IDE adapter. A dual-channel adapter designed to connect with two to four IDE disk drives, the AC-Mirror automatically switches disk activity away from failed drives to the working drives upon detecting an error, then notifies the user. The card is a hardware-based adapter and, thus, installs without software drivers. $195. *ARCO Computer Prods., Inc., 2750 N. 29 Ave., S-316, Hollywood, FL 33020; tel.: 305-925-2688; fax: 305-925-2889; Internet: fttp://www.arcoide.com/adapters.*

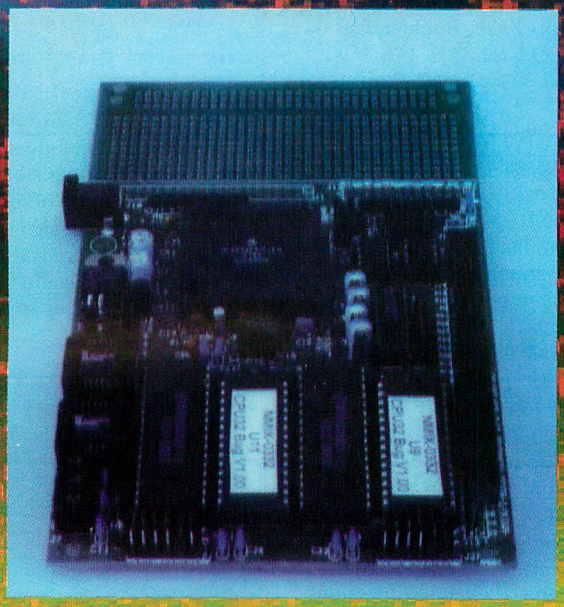
CIRCLE NO. 4 ON FREE CARD

Notebook Modem Mate

The MPA-100 Modem Mate from TT Systems lets you connect a notebook modem to vir-

68332 CPU

with C, Forth, Assembler, & CPU32BUG software, all included!



$295

68010 Core 20 MHz
RS-232/422/485
Flexible decode:
Upto 1M RAM, 2M
EPROM onboard

Here's a deal! A 68332 based Single Board Computer with a PC based C compiler and cross assembler supplied on disk, and CPU32BUG Monitor and Max-FORTH installed in EPROMs, all for the low price of $295. This is the fully featured NMIX-0332-PS Single Board Computer. The CPU is supported with a power supply of rectifier, regulator, filter caps and wall transformer. Either RS-232, or RS422/485, converters (both provided) can be used on the asynchronous serial port.

The 68332 has a Queued Serial Module (QSM - SCI asynchronous & SPI synchronous serial ports), a System Integration Module (SIM - programmable chip selects, Watch Dog Timer, Periodic Interupt) and, most importantly, a Time Processing Unit (TPU - 16 independent programmable channels, each with an input/output pin).

Four memory sockets on the board have a flexible address decoding scheme. Programming of four chip-selects generated on the 68332 with external support in low-power programmable logic allows use of any 8Kx8 - 1024Kx8 JEDEC memory devices in the 32-pin sockets, by simple jumper setting. Up to 2Mbytes of EPROM and 1Mbyte of RAM can be accomodated on the board (256K fully static RAM is the factory default). Expansion connector allows additional off board memory, to the full 24Mbyte address range of the 68332. Numerous expansion peripheral boards are available.

Since the monitor and Forth are already installed, you can take the board out of the box, hook it up to your PC's serial cable, plug in the wall transformer, install the communication software, and begin programming in the high level language of your choice (C or Forth provided, or any of the third-party 68000 development environments). Or work in assembler - the monitor has a built-in line assembler, disassembler with breakpoint capability. Connections for Background Debug mode cable are provided. Here's the easy way to begin powerful 68000 embedded applications. Call New Micros, today!

Tel: 214-339-2204 Fax: 214-339-1585 Fax-on-Demand: 214-339-2234 Web: http://www.newmicros.com/general/

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CIRCLE NO. 80 ON FREE INFORMATION CARD

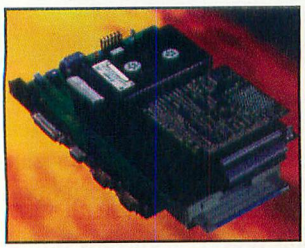


tually any telephone system. Connection is accomplished through any modular handset. The device is suitable for all analog and digital telephone systems and has the potential to achieve baud rates up to 28.8K bps. $120. *TT Systems Corp., 7 Odell Plaza, Yonkers, NY 10701; tel.: 914-968-2100; fax: 914-968-2155.*

CIRCLE NO. 9 ON FREE CARD

PC/104 Development Environment

TCDEV from The Saelig Co. is a stand-alone development environment for PC/104-based



peripherals. It is a single board that comes mounted on a 3½" floppy-disk drive. It accommodates one Saelig Target Card processor board and several I/O boards. TCDEV provides mouse and keyboard connectors and serial, parallel and VGA ports. $680. *The Saelig Co., 1193 Mosely Rd., Victor, NY 14564; tel.: 716-425-3753; fax: 716-425-3835.*

CIRCLE NO. 10 ON FREE CARD

Microcontroller Kit

TICkit microcontroller from Versa Tech Electronics uses a PIC16C57 programmed with an FBASIC language interpreter and I²C EEPROM. A suite of library functions implemented in the interpreter provides a wide variety of I/O options. TICkits range from 2K EEPROM and 4-MHz interpreter to 8K EEPROM and 20-MHz interpreter. A development kit is sold separately. $49/$65/$45, 2K/8K/Dev. Versa Tech Electronics, PO Box 18476, Boulder, CO 80308; tel.: 303-440-5590; fax: 303-440-9467.

CIRCLE NO. 11 ON FREE CARD

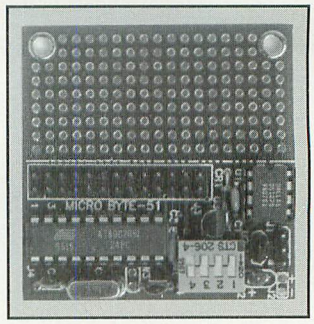
BASIC Stamp II

The BASIC Stamp II form Parallax is a complete BASIC-programmable computer in a 24-pin DIP package. It contains 16 I/O lines and 2K of non-volatile memory and has a clock speed of 20 MHz. Most I/O functions are digital and include serial communication, pulse measurement, button input, transition counting, etc. A few functions are pseudo-analog, such as resistance measurement and PWM. Stamp II even has functions for transmitting X-10 power-line control signals, as well as for generating accurate audio frequencies, including DTMF tones for telephone dialing. $49. *Parallax, Inc., 3805 Atherton Rd., #102, Rocklin, CA 95765; tel.: 916-624-8333; fax: 916-624-8003.*

CIRCLE NO. 12 ON FREE CARD

8051 SBC

MICRO BYTE-51 from Allen Systems is a miniature single-board computer that's based on the 8051 family of microcontrollers. The device installed on the board is the 89C2051, a fully static CPU with clock speeds up to 24



MHz. The main feature of this CPU is its on-chip 2K Flash memory for program storage. Board features include a 2" x 2" footprint, the DS1833 5V EconoReset chip, the DS1275 RS-232 transceiver and a prototyping area. $39. *Allen Systems, 2346 Brandon Rd., Columbus, OH 43221; tel.: 614-488-7122.*

CIRCLE NO. 13 ON FREE CARD

Digital Output Card

The CIO-DO48H from Computer Boards ISA-bus card contains 48 lines of dedicated digital output. It's a high-drive device that's capable of sourcing 15 mA and sinking 64 mA. Solid-state relay modules, some electromechanical relays and LEDs can be activated directly from the card. $99. *Computer Boards, Inc., 125 High St., Mansfield, MA 02048; tel.: 508-261-1123; fax: 508-261-1094.*

CIRCLE NO. 14 ON FREE CARD

Printers

Windows Laser Printer

Texas Instruments' microLaser WIN/4 laser printer is a compact, 600-dpi, 4-



ppm printer that uses the Microsoft *Windows* Printing System. It features a 100-sheet paper bin and separate toner and drum cartridges. All printing functions are managed through *Windows* menus. $449. *Texas Instruments, Inc., 5701 Airport Rd., Temple, TX 7650; tel.: 817-774-6001.*

CIRCLE NO. 15 ON FREE CARD

Label Printers

CoStar's LabelWriter ASCII



and ASCII Plus small-size desktop label printers can operate on standard PCs without requiring special software. The printers support a subset of the standard Epson FX command language and can print all standard ASCII characters as well as POSTNET barcodes. Both printers employ a direct thermal print method, have two built-in fonts and include a standard serial interface. Print resolution is 203 dpi. The ASCII model has a maximum print width of 1", while the ASCII Plus can print up to 2.25" wide. $299.95/$349.95, A/AP. *CoStar Corp., 10 Field Point Rd., Greenwich, CT 06830; tel.: 203-661-9700; fax: 203-661-1540.*

CIRCLE NO. 16 ON FREE CARD



Kroy's K255 On-Line Labeler prints labels up to 2.25" wide and is compatible with True-Type fonts. The label printer can be controlled by its own software or from a word processor or database. The software lets you import graphics or scanned images onto labels, print POSTNET and other barcodes and save label formats and addresses. The printer plugs into a PC's serial port. *Kroy, Inc., 14555 N. Hayden Rd., Scottsdale, AZ 85260; tel.: 602-948-2222; fax: 602-951-7033.*

CIRCLE NO. 17 ON FREE CARD

Graphics Cards

Multimedia Accelerator

The Voyager Movie Player from Boca Research integrated multimedia video graphics card is based on S3's Trio-64V+ multimedia accelerator, Scenic/MX2 MPEG decoder and Sonic/AD audio DAC. It combines true 64-bit graphics, video acceleration and hardware MPEG with SRS Labs 3D Surround Sound, all on the same PCI bus card. The Voyager Movie Player comes with 1M of RAM. $399. *Boca Research, Inc., 1377 Clint Moore Rd., Boca Raton, FL 33487; Tel.: 407-997-6227; fax: 407-994-5848.*

CIRCLE NO. 18 ON FREE CARD

Video Editing Card

Q-Motion's PCI Digital Video Editing PCI Bus Master card utilizes PCI DMA to improve throughput and performance. Q-Motion PCI is able to transfer bursts of digital video at up to 132M/s without slowing the performance of the system on which it runs. The board features full-speed video capture at 640 x 480 resolution, Motion-JPEG compression, support of standard and professional video formats and compatibility with Microsoft *Video for Windows*. $799. *Quadrant Int'l., Ste. 102, Wayne, PA 19087; tel.: 610-964-7600; fax: 610-964-8195.*

CIRCLE NO. 19 ON FREE CARD

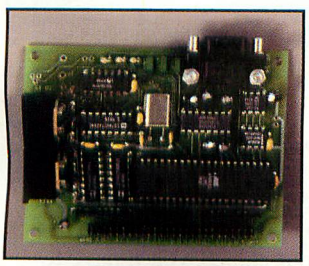
Microstepper Driver

MicroKinetics' DM4050 microstepping driver is a 40-volt, 5-ampere per phase stepper motor driver that provides 400 watts of power in a compact package. Features include full anti-shorting, easy screw terminal hookup, bipolar constant-current chopper circuitry for maximum efficiency, idle current cutback and DIP-switch-selectable current and resolution. $199. *MicroKinetics Corp., 2117-A Barrett Park Dr., Kennesaw, GA 30144; tel.: 770-422-7845; fax: 770-422-7845.*

CIRCLE NO. 20 ON FREE CARD

Keyboard Interface

The KE24 from Hagstrom Electronics interfaces keypads or switches to a PC/compatible keyboard input. The 24 I/O lines of the encoder can be configured as either rows or columns in up to a 12 x 12 matrix or as individual inputs. Each input can be programmed to emulate any of the standard keys found on a 101 key keyboard or output a macro of up to 16 keystrokes. The unit also features an RS-232 port for conversion of received characters into PC-compatible keystrokes. The KE24 can operate alone or in conjunction with a PC keyboard. $99.95. *Hagstrom Electronics, Two Green Lantern Blvd., Endicott, NY 13760; tel./fax: 607-786-7523.*



CIRCLE NO. 21 ON FREE CARD

Software

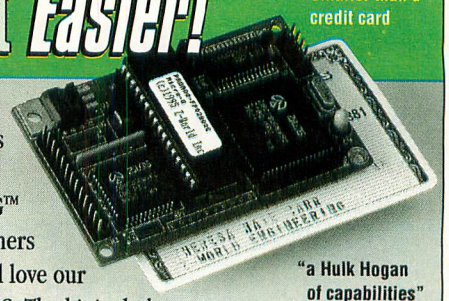
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(Continued on page 115)

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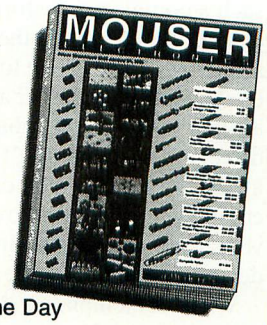
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By Joseph Desposito

All About Motherboards and RAM

A guide to the technology available to upgrade your PC and peripherals

To keep up with rapidly changing technology in the PC industry, you either have to purchase a new system every one or two years or upgrade your old one. While not inexpensive, upgrades offer a less-costly path to state-of-the-art performance and technology. In this article, I cover two of the most-important upgrades you can make to your PC: the motherboard and RAM. I explain the different choices available and provide information you need to make an intelligent choice about your next upgrade.

About Motherboards

One of the best ways to increase computing power, short of purchasing a new system, is to upgrade your motherboard. This type of upgrade can transform your PC from a plodding 386 "has-been" to a cutting-edge Pentium screamer. There's virtually no other upgrade that can accomplish such a complete transformation. Of course, depending on the age of your system, you may have to upgrade other elements of your PC as well, such as your video adapter, hard-disk drive, etc. But you don't have to do all of this at once. You can add these components gradually over time, which spreads out the financial burden of a system upgrade.

When contemplating a motherboard upgrade, you have many decisions to make. In this section, I explain the major parts of a PC motherboard, including microprocessor, chipset, system DRAM, SRAM cache, bus, expansion slots, I/O ports, BIOS, etc. (Fig. 1). Then I tell you who the major motherboard manufacturers are and what you can expect to pay for different motherboard configurations (be advised, though, that prices I give here are as of early January and may be less to a lot less by the time you read this). Finally, I include a buyer's-guide chart that tells you where you can purchase the motherboard of your choice.

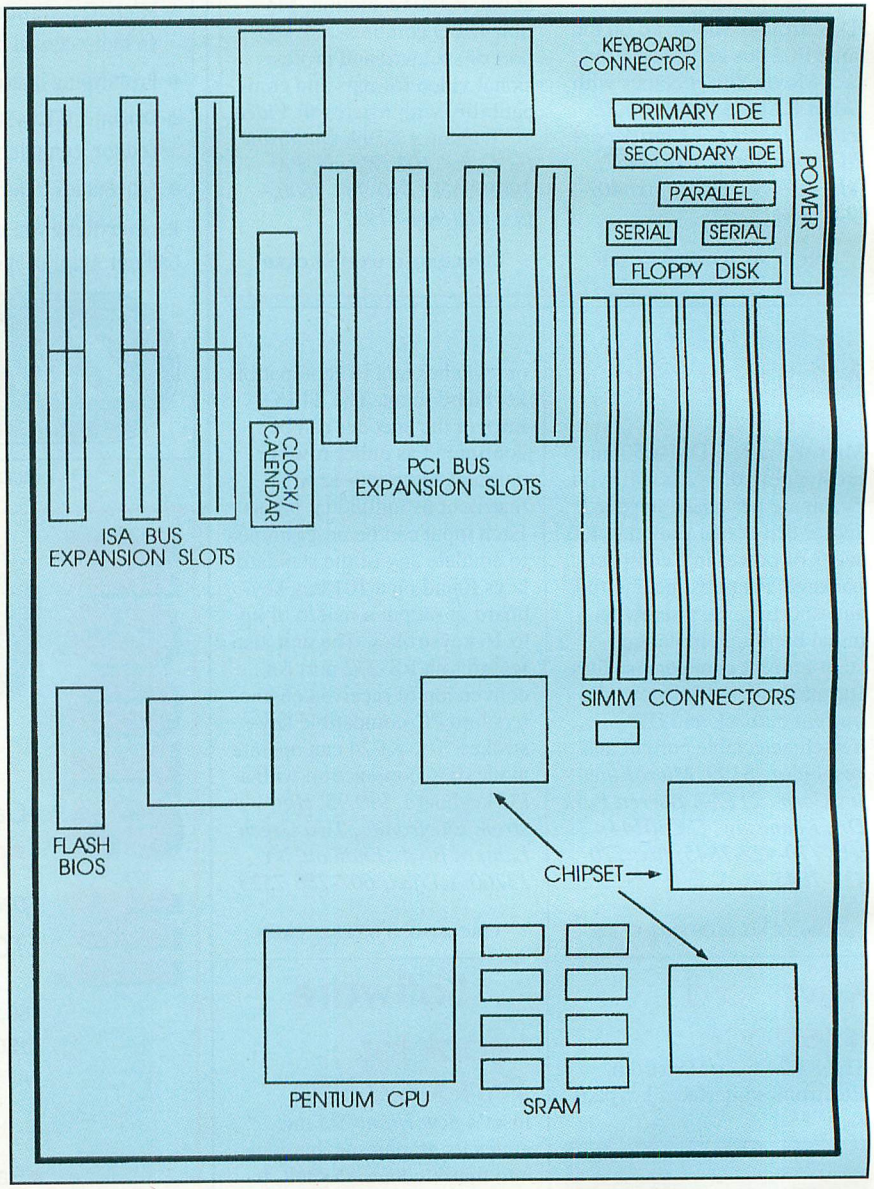


Fig. 1. Layout of a typical PC motherboard.

• ***Microprocessor.*** Obviously, the most-important chip on a motherboard is its microprocessor (or CPU or MPU, depending on your reference). When making your choice, you'll have to

decide whether you want to move up to a Pentium processor or stay with a fast 486 CPU. The latter allows you to purchase a much-less-expensive motherboard. In terms of speed, a 100-MHz 486 is roughly equivalent to a 75-MHz Pentium processor.

Once you make the Pentium/486 decision, you must decide on speed. Though 486 DX chips run as slow as 25 MHz, you won't want to accept any speed slower than 66 MHz, especially if you plan to run *Windows 95* on your machine. Currently, 486 processors top out at 120 MHz (these are from AMD). Pentium-class processors start at 60 MHz and go all the way up to 150 MHz (and counting).

Some high-end motherboards are designed for dual-Pentium operation, a feature that isn't available with the 486 chip. (Though Intel's new Pentium Pro is on the horizon, I didn't find any motherboards in the consumer marketplace that use this next-generation chip at the time of this writing.) You'll find that upgrading from a 33-MHz 486SX, a very popular chip in its time, to a 90-MHz or faster Pentium provides a remarkable performance boost.

Choosing a motherboard that has a processor from a company other than Intel—for example, AMD, Cyrix or NexGen—will save you some money. I've found motherboards that use variations of the AMD 486, Cyrix 486 and 586 and NexGen 586 CPUs.

Keep in mind that some motherboards are advertised *without* a microprocessor installed on them. In this case, you purchase the microprocessor separately. If you plan to install and remove the microprocessor, it's best to buy a motherboard that has a ZIF (zero-insertion-force) socket.

A ZIF socket greatly facilitates installation and removal of the CPU. Also, Pentium-level microprocessors employ a cooling fan that sits atop the processor. You may have to order this separately if the processor isn't included on the motherboard you plan on buying.

Some motherboards are rated for processor speeds that are greater than are currently available. For example, a motherboard may be rated for 166 MHz. If you plan on upgrading your processor as new models become available, you should make sure to check out maximum ratings.

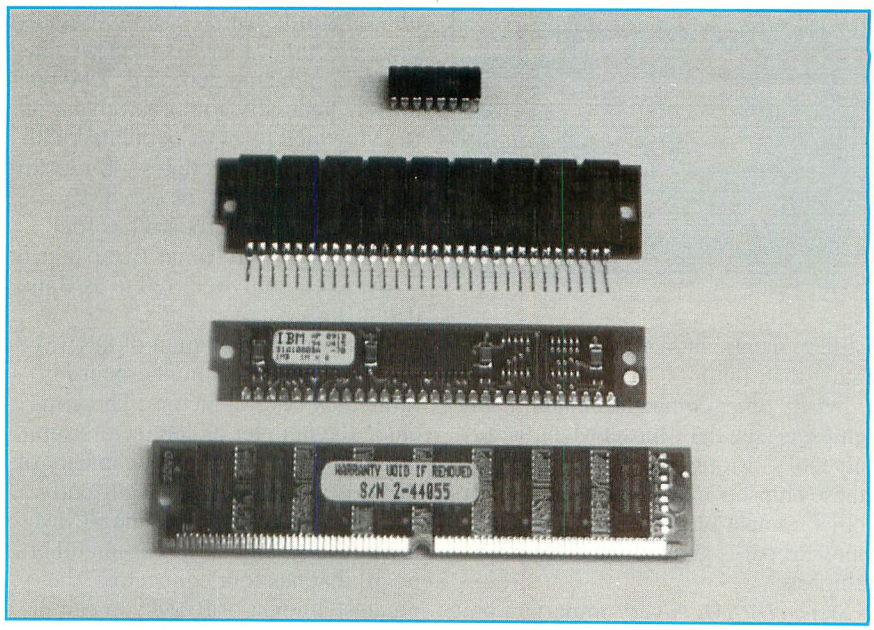


Fig. 2. From top to bottom are shown DIP, SIPP, 30-pin SIMM and 72-pin SIMM devices.

• ***Chipset.*** Every motherboard manufactured nowadays includes a set of chips (usually three) that handle many of the common computing functions. This wasn't always the case. The original IBM PC, for example, was built with off-the-shelf ICs. The functions of these discrete ICs are now integrated into the chipset. Some of Intel's chipsets are named Triton, Neptune, Mercury, Saturn II, Plato and Aries.

Triton is used on the fastest Pentium-based motherboards, while Neptune is usually found on dual-processor Pentium motherboards. Keep in mind that a motherboard may use an Intel processor and Intel chipset, but

Competing With the Pentium

If you want to move up to Pentium-class performance but don't have the funds needed to do so, you may want to consider one of the alternatives to Intel Pentium-based motherboards. Two alternatives were available at the time of this writing. You can opt for either a Cyrix 5x86 chip on a 486/DX4-type motherboard (available from Legend Micro and others) or a NexGen Nx586 motherboard.

The features of the Cyrix 5x86 processor include a 64-bit internal architecture, branch prediction, data forwarding and multiple operations issued by clock (made possible by a decoupled load/store unit). These are combined with an 80-bit Floating Point Unit (FPU) and 16K unified write-back cache.

A super-pipelined Integer Unit fetches, decodes and executes x86 instructions through use of a six-stage integer pipeline. The processor's built-in power-saving features automatically power down the FPU and other idle internal circuits, while the System Management Mode (SMM) conserves power flowing to system peripherals.

The Cyrix 5x86 fits into P24D sockets, which are found on 486/DX4-type motherboards. But this chip isn't designed to be an upgrade because the motherboard must have a BIOS that supports the 5x86.

The NexGen Nx586 family of processors is based on NexGen's patented RISC86 micro-architecture. This applies RISC-level performance techniques to the x86 instruction set and incorporates such state-of-the-art computer architecture techniques as out-of-order execution, speculative execution, register renaming, data forwarding, and two-level branch prediction. The processors also incorporate 32K of Level 1 cache and an on-chip Level 2 cache controller with a private full-speed 64-bit Level 2 cache bus. The disadvantage of this processor is that it doesn't have an on-board FPU.

At the time of this writing, the only motherboards available with NexGen processors were NexGen models.

Chipset Manufactures

Manufacturer	Where
Acer Laboratories, Inc.)	Taiwan
Intel Corp.	Santa Clara, CA
NexGen, Inc.	Milpitas, CA
OPTi, Inc.	Milpitas, CA
SIS	Taiwan
UMC	Taiwan
VLSI Technologies	San Jose, CA

These manufacturers produce most of the chipsets found on **486- and Pentium-class motherboards.**

still be manufactured by a company other than Intel.

Many other companies manufacture chipsets (see the Chipset Manufacturers table). Motherboards that use these chipsets may employ an Intel or other compatible processor. NexGen motherboards generally use NexGen chipsets.

• ***System DRAM.*** A very-important part of any motherboard is the area that holds the system DRAM (dynamic or so-called "system" RAM). Connectors in this area may hold 30-pin SIMMs (single in-line memory modules), 72-pin SIMMs or both. Usually, there are either four, six or eight connectors on the motherboard. Two connectors generally comprise a bank of RAM, which must be populated with the same-density modules—for example, two 4M SIMMs or two 8M SIMMs. If a motherboard has four SIMM connectors, it has two banks of RAM, commonly referred to as Bank 0 and Bank 1.

The maximum amount of DRAM you can install on a motherboard is limited by several factors. These include the number of connectors supplied on the motherboard, capacity of the largest SIMM module currently available and capacity of the SIMM modules actually used. For a motherboard that has four connectors, the greatest amount of RAM you can install will be 128M, assuming 32M modules.

Realistically, you'll probably purchase 4M or 8M modules, due to the high cost of RAM, which limits the total capacity of your system. (Keep in mind that you must purchase two SIMMs of the same capacity to fill a bank.) If you plan to use 64M or 128M modules as these become available, make sure your motherboard can support these greater capacities.

If you plan to use DRAM from an older motherboard, check the type of DRAM packaging used. On 286 motherboards, DIP (dual in-line package) DRAM was most popular, while on 386 boards, SIPPs (single in-line packages) were in vogue. Most 486 boards used 30-pin SIMMs.

Carrying over older DRAM chips to your new motherboard poses a few problems. DIPs, SIPPs and 30-pin SIMMs will obviously not fit into 72-pin SIMM connectors, though you can buy converters that will help you to do this (see the RAM Converter Suppliers table). Even with a converter, the low capacity of older modules, usually 1M, generally limits the capacity of the converter to 4M.

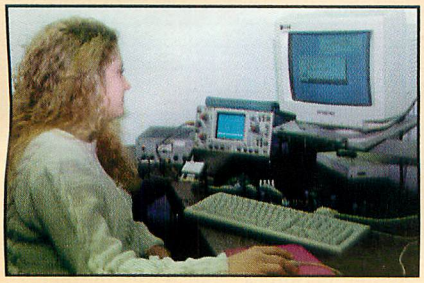
Motherboard Suppliers

Supplier	Intel Z	Intel E	Intel A	Micronics 486	Micronics P	ASUS 486	ASUS P	Super Micro P	ECS 486	ECS P	Biostar 486	Biostar P	Acer 486	Acer P	AMI P	NeoGen Nx586	IBM 486	Other 486	Other P
Aberdeen	o	o				o	o	o	o									o	
AMPTech*	o	o										o						o	
CompuAmerica																		o	o
Compustar Computers	o	o																o	o
Dee One Systems	o	o																o	o
First Computer Systems	o	o						o										o	o
Galaxy Computers																		o	o
GIFI																		o	o
Hi-Tech USA	o	o					o											o	o
IDER							o										o	o	
InterPro Microsystems	o	o				o	o	o			o	o			o			o	o
Jameco Computer Products					o													o	o
JDR Microdevices																			o
Legend Micro	o																	o	o
Megatech	o				o			o							o	o		o	o
Micro-Assist			o		o			o										o	o
MicroMax	o	o						o										o	o
Micro Pro	o																	o	o
Micro Time	o																	o	o
Micro Xperts	o										o	o		o				o	o
Motherboard Discount Center	o					o	o	o	o	o					o			o	o
Motherboard Eopress	o	o		o	o		o								o			o	o
Motherboards International	o	o			o	o	o	o										o	o
NCA Computer Products	o																	o	o
Pacific Computer Products	o	o				o	o								o		o	o	o
PC Eopert	o				o		o						o	o				o	o
PC Importers	o	o										o						o	o
PC InterActive	o	o																o	o
PC International																		o	o
SeeWhy Computer Systems																	o	o	o
SoftHard Systems								o											o
Sky 1 Technologies	o																	o	o
TC Computers	o	o			o	o	o											o	
TDNetwork																o		o	o
TechnoMedia Corp.																		o	o
V88 Computer Systems	o	o				o	o	o							o	o		o	o
Windows Memory Corp.	o	o						o										o	o
Worldwide Technologies	o																	o	o

o indicates company advertises this brand of motherboard Z = Zappa A = Atlantis E = Endeavor P = Pentium
*AMPTech = American Micro Products Technology **TDNetwork = Technology Distribution Network

Microprocessor Development Packages

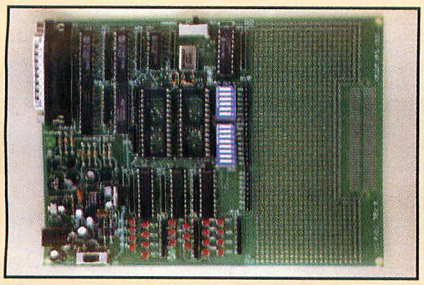
PIC Point and Click



CodeAx Application Builder Software & Development Board

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CodeAx application builder software configures, initializes and performs other software overhead tasks automatically. You choose the microprocessor and accessory boards. Complete your circuit *in the* prewired prototype area. Click through the screens and set values or accept defaults for your system. Create fully commented source code; add custom code as desired.



Pic-PD Development Board

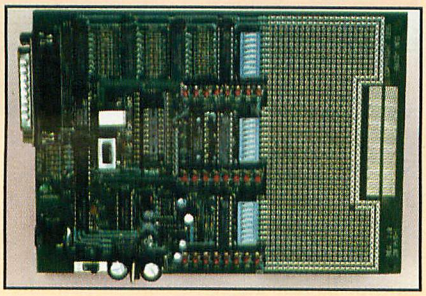
$99.00 ea.

Features:

- Port status LEDs
- Built in programmer
- Proto Area
- Pic 5x,6x,7x,8x Series
- Power supply included
- Includes Assembler

Z8 Point and Click

Learn New Processors Quickly Reduce Development Cycle

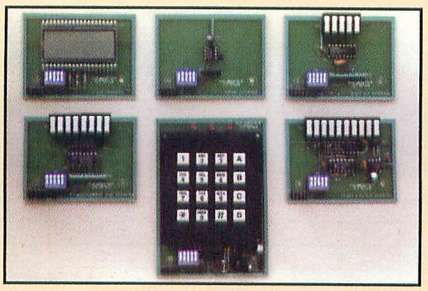


Z 8-PD Development Board

$99.00 ea.

Features:

- Port status LEDs
- Built in programmer
- Proto Area
- Zilog Z8, 03, thru 32 Series
- Power supply included
- Includes Assembler

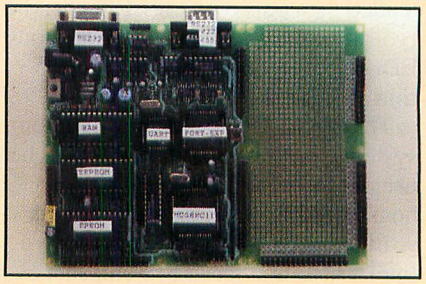


Accessory Boards

Accessory Boards:

- Key Pad
- LCD
- EEprom Storage
- High Current Driver
- A/D Converter
- D/A Converter
- Production CPU

68HC11



CMD-11A8 Development Board

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Features:

Board:

- MC68HC11A8 w/8CH 8Bit A/D
- 120 x 160 mm Board Size (5x6)
- Large 120 x 60mm proto area
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- 8K EEPROM
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Comes With:

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Added to the foregoing difficulties is the issue of speed. Older SIMMs may be rated at 80 ns, whereas today's 100-MHz and beyond motherboards usually require 60-ns modules.

Until recently, the type of DRAM used in PCs was designated as "fast page-mode" RAM. To gain greater system speed, a new type of DRAM has been developed, called EDO (extended data out) or burst EDO DRAM (you'll find the technical details about EDO DRAM later in the RAM section of this article).

Though EDO DRAM can give your system a performance boost, it will be useless to you unless your motherboard was designed for it. As of this writing, only motherboards that have Intel Triton and latest SIS chipsets support EDO DRAM.

Since motherboard prices are quoted *without* system DRAM, you always need to factor the cost of DRAM into your upgrade equation. For example, you may find yourself spending $250 for a 100-MHz 486 motherboard and then $260 for 8M of DRAM to install on the board.

• ***SRAM Cache.*** Unlike the DRAM situation, most motherboards come with a complete complement of SRAM (static RAM) that's used as a second-level cache and usually ranges from 128K to 512K. The first-level cache is built into the 486 or Pentium processor. In some cases, a motherboard that can accommodate a certain amount of SRAM will come with only half that amount installed on it. For example, a motherboard designed with a 256K cache will come with only 128K onboard. In this case, you can install the remaining amount of SRAM at a later time, if you so desire.

There are various flavors of SRAM, including standard and pipelined burst (more on this later). As with EDO DRAM, motherboards must be specifically designed to use these kinds of SRAM.

• ***System Bus.*** The bus wars appear to be over. Intel's 32-bit PCI local bus has won it hands down—no more MicroChannel to worry about, EISA is on the wane and the VESA local bus is available only on 486-based motherboards. If you're contemplating whether you should purchase a fast 486 or a Pentium motherboard, the type of bus should enter into your decision.

Keep in mind that if you purchase a motherboard that has a VESA local bus, you may also wind up purchasing a VL-bus graphics card. Then if you upgrade again a year from now to a Pentium-level motherboard, your graphics-card investment will be wasted. If you do decide to remain with the 486, look for a motherboard that supports both VESA and PCI, or better yet, only PCI.

Typical Motherboard Pricing

Type	CPU	Price
66 MHz 486 VLB	With Cyrix CPU	$155
	With AMD CPU	$165
	WithIntel CPU	$209
100 MHz 486 VLB	With Cyrix CPU	$185
	With AMD CPU	$195
	With Intel CPU	$249
90 MHz Pentium PCI	Intel (With Triton Chipset)	$549
	Biostar (With Triton Chipset)	$519
	Acer (With SIS Chipset)	$479
90 MHz Nx586 PCI	NexGen (With NexGen Chipset)	$269
120 MHz Pentium PCI	Intel (With Triton Chipset)	$899
	Asus (With Triton Chipset)	$875
	ACHME (With SIS Chipset)	$839
120 MHz No586 PCI	NeoGen (With NexGen Chipset)	$595
133 MHz Pentium PCI	Intel (With Triton Chipset)	$1,019
	Biostar (With Triton Chipset)	$989
	Acer (With SIS Chipset)	$949

RAM Suppliers

	DRAM SIMMs				Notebook					Printer			
Supplier	30-Pin	72-pin	EDO	SRAM	Video	BM	Toshiba	NEC	Other	HP	Epson	Okidata	Other
ACE Micro	o	o	o	o		o	o	o	o	o	o	o	o
Altex Electronics	o	o											
AmRam	o	o	o										
ASAPc Direct	o	o	o			o	o	o	o	o	o	o	o
Avalon Micro Liquidators	o	o	o	o	o					o	o	o	o
Data Memory Systems	o	o			o				o				o
Deniz Corp.	o	o				o							
Eritech	o	o		o	o								
First Source International	o	o		o		o	o	o	o	o	o	o	o
H&J Electronics Int'l.						o	o	o	o	o	o	o	o
H.Co. Computer Products						o	o	o	o	o	o	o	o
LA Trade	o	o	o	o		o	o	o	o	o	o	o	o
Megatech	o	o	o										
Memory 4 Less	o	o		o	o	o	o	o	o	o	o	o	o
Memory and CPU & Whse.	o	o	o										
Memory Express	o	o	o	o		o	o	o	o				
Memory Megastore	o	o	o						o	o	o	o	o
Motherboards International	o	o	o										
Notebook Supersource						o	o	o	o				
Sky 1 Technologies	o	o	o	o		o	o	o	o	o	o	o	o
The Chip Ship	o	o	o	o									
Windows Memory Corp.	o	o											
WorldWide Memory	o	o	o			o	o	o	o	o	o	o	o
Worldwide Technologies	o	o	o	o		o	o	o	o	o	o	o	o

o indicates company advertises this type of RAM.

Pinouts for 72-Pin SIMM DRAM Module					
Pin	Non-Parity X 32	Parity X 36	Pin	Non-Parity X 32	Parity X 36
1	Vss	Vss	37	--	PQ17
2	DQ0	DQ0	38	--	PQ35
3	DQ18	DQ18	39	Vss	Vss
4	DQ1	DQ1	40	CAS0*	CAS0*
5	DQ19	DQ19	41	CAS2*	CAS2*
6	DQ2	DQ2	42	CAS3*	CAS3*
7	DQ20	DQ20	43	CAS1*	CAS1*
8	DQ3	DQ3	44	RAS0*	RAS0*
9	DQ21	DQ21	45	RAS1*	RAS1*
10	Vcc	Vcc	46	--	--
11	--	--	47	WE*	WE*
12	A0	A0	48	--	--
13	A1	A1	49	DQ9	DQ9
14	A2	A2	50	DQ27	DQ27
15	A3	A3	51	DQ10	DQ10
16	A4	A4	52	DQ28	DQ28
17	A5	A5	53	DQ11	DQ11
18	A6	A6	54	DQ29	DQ29
19	--	A10	55	DQ12	DQ12
20	DQQ4	DQ4	56	DQ30	DQ30
21	DQ22	DQ22	57	DQ13	DQ13
22	DQ5	DQ5	58	DQ31	DQ31
23	DQ23	DQ23	59	Vcc	Vcc
24	DQ6	DQ6	60	DQ32	DQ32
25	DQ24	DQ24	61	DQ14	DQ14
26	DQ7	DQ7	62	DQ33	DQ33
27	DQ25	DQ25	63	DQ15	DQ15
28	A7	A7	64	DQ34	DQ34
29	--	A11	65	DQ16	DQ16
30	Vcc	Vcc	66	--	--
31	A8	A8	67	PD1	PD1
32	A9	A9	68	PD2	PD2
33	RAS3*	RAS3*	69	PD3	PD3
34	RAS2*	RAS2*	70	PD4	PD4
35	--	PQ6	71	--	--
36	--	PQ8	72	VSS	Vss

All PC motherboards continue to support the 16-bit ISA standard. This bus design first appeared on the IBM AT and exists to this day. The ISA bus provides compatibility with eight- and 16-bit ISA-based add-in cards.

• ***Expansion Slots.*** Closely related to the system bus are the expansion slots on the motherboard. If you plan on expanding your system with ISA, PCI or VESA add-in cards, you must take particular notice of the type and number of slots on the motherboard. A typical motherboard might contain four PCI or VESA slots and three 16-bit ISA bus slots (which accept both 16- and eight-bit add-in cards).

• ***I/O Ports.*** Most motherboards nowadays have built-in I/O ports. Typically, you'll find one or two serial ports, a parallel port and floppy and hard-disk interfaces. Some motherboards even have a built-in mouse port. Serial ports generally use the high-speed 16550 UART or its equivalent, while parallel ports support the new ECP/EPP standard. The floppy-disk controller hasn't changed much over the years, though the hard-disk controller generally found on today's motherboard is the new EIDE (enhanced IDE) type.

Motherboards that have built-in EIDE interfaces have four connectors for four hard drives (two masters and two slaves) or for two hard drives and such peripherals as a CD-ROM drive or optical scanner with an IDE interface. The newest EIDE interfaces support PIO Modes 3 and 4 that feature a maximum transfer rate of 17M/s and DMA Mode 2 that features a maximum transfer rate of 22M/s.

If you prefer SCSI over IDE, you can find motherboards that have a built-in interface like the Adaptec 2940W fast and wide SCSI-3 and SCSI-2 interfaces. Having a built-in IDE or SCSI interface doesn't limit you to one or the other. A SCSI or IDE interface card can still be added to an expansion slot on the motherboard.

• ***BIOS.*** The system BIOS (Basic Input/Output System) often resides in a ROM chip that's located on the motherboard. This system firmware—from manufacturers like AMI, Award and Phoenix—is usually the culprit when compatibility and other kinds of problems affect the system. If the BIOS is burned into a ROM, manufacturers can make amends for errors by sending you a new ROM with revised software. To avoid this scenario, BIOS manufacturers are now placing their code in a flash memory chip.

Flash memory can be erased and reprogrammed electronically. The manufacturer provides the revised software on a diskette or through a BBS download. The software does the entire job of erasing the old code and downloading the new code into the chip.

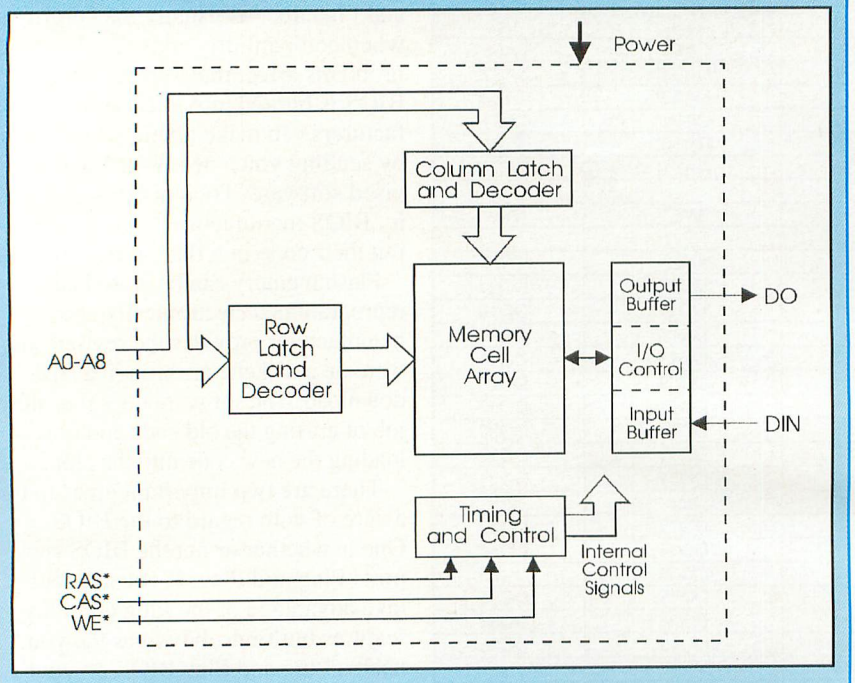
There are two important areas to be aware of with regard to the BIOS. One is whether or not the BIOS supports Plug and Play. If you expect to take advantage of the Plug and Play features built into *Windows 95*, you need a Plug and Play BIOS on your motherboard. The other is that if you plan to use a hard drive that has a capacity in excess of 540M, make sure that the BIOS supports this. If it doesn't, you'll be forced to use some kind of disk-management software, such as *Disk Manager* from Ontrack Computer Systems.

If a motherboard has a BIOS from a company that isn't familiar to you, ask the manufacturer of the motherboard if and how you'll receive a revision should this become necessary. Even if you don't experience problems with your motherboard, call the manufacturer every so often to inquire as to whether or not the BIOS for your motherboard has been revised.

Motherboards advertised as "green" include power-saving features in their BIOSes. In other words, you can set up your system so that different on-board functions turn off after a certain amount of time during which there's no input activity has elapsed. For the most part, though, newer motherboards all contain these green features in their BIOSes.

• ***Motherboard Manufacturers.*** Motherboards are manufactured by many different companies, including Intel, Micronics, IBM and a host of lesser-known manufacturers (see the Motherboard Suppliers table). Intel and Micronics produce state-of-the-art moth-

How DRAM Works

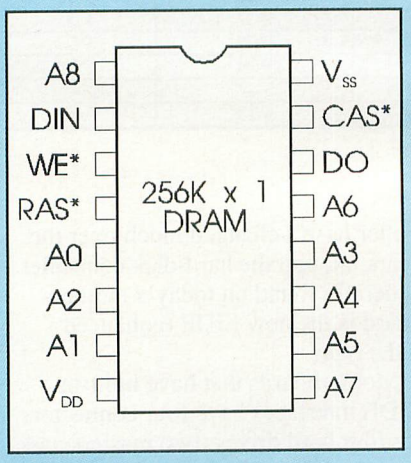


To understand how DRAM works in a PC, let's take a look at the operation of a simple DRAM chip, such as the 256K X 1 DIP chip used on older PC motherboards. DRAM contains an array of cells that store data in terms of 0s and 1s. Each cell is constructed with one or more transistors and a capacitor. The charge on the capacitor determines the state of the cell (charged = 1, discharged = 0).

Each cell has a column address and a row address that, in effect, make up the coordinates of the cell. The DRAM chip has a single set of address pins (labeled A0 through A8). Pins are used for both the column and row addresses at different times (the addresses are multiplexed).

In operation, first the row address is placed on the address pins. Then the RAS* (Row Address Strobe) changes from high to low state. This causes the DRAM to store the row address in the row latch. The row address is then removed from the address pins, and the column address is loaded. Then the CAS* (Column Address Strobe) changes from high to low state. This causes the DRAM to store the column address in the column latch. At this point, the DRAM decodes the two stored addresses to locate the addressed cell.

After the cell is selected, data can be written into it by applying a 0 or 1 on the DIN (Data In) pin and applying a pulse to the WE* (Write Enable) pin. Data stored in RAM can be read via the DO (Data Out) pin, which assumes the state corresponding to the selected cell.



The minimum number of DRAM chips needed to implement memory depends on the width of the microprocessor's external data bus. In the case of a DRAM with a X 1 organization, the minimum number of chips needed is equal to the width of the data bus since each DRAM contributes only one bit per memory word. For example, a microprocessor with a 16-bit data bus needs at least 16 DRAM chips. Sixteen 256K X 1 DRAMs would supply a memory capacity of 256K.

Since DRAM construction includes a capacitor, each cell must be read periodically, the voltage compared to a reference value and the charge restored to the capacitor if the data is supposed to be a 1. This process is called memory refresh.

erboards that have on them the fastest chips available. Intel also names its motherboards to help you keep track of them. For instance, at the time of this writing, Intel's latest models are the advanced Atlantis, Endeavor and Zappa. IBM doesn't compete with Intel and Micronics in the high-end marketplace. Instead, it manufactures a series of 486-based Blue Lightning and Opal motherboards.

If you purchase an Intel or Micronics motherboard, you pay a premium for it. To save some money, you may want to choose a motherboard that has on it an Intel chipset (Triton or Neptune, for example) and processor but is manufactured by another company. To save even more money, you may want to choose a motherboard that has an AMD or other Intel-compatible microprocessor on it.

• ***Extras.*** In the old days, motherboards provided very little in the way of extras. I/O ports, for example, were on a separate add-in card. Nowadays, you can find motherboards that even include built-in sound and video chips. For example, built into the Intel advanced Endeavor motherboard is Creative's SoundBlaster Vibra 16S sound chip. Built into Intel's advanced Atlantis motherboard is the Vibra 16S sound chip and the ATI Mach 64 video controller.

• ***Motherboard Pricing.*** To give you an idea of how much a particular motherboard costs, the Typical Motherboard Pricing table lists the various prices asked at this writing for models ranging from 66-MHz 486 through 150-MHz Pentium models. I've included several variations to illustrate the difference, for example, between an Intel motherboard and one manufactured by a competitor.

About RAM

You probably know by now that to run *Windows 95* you need a minimum of 8M of DRAM just to satisfy the *recommended* requirements for Microsoft's latest incarnation of its industry-standard operating system. Of course, 16M is better, and an even greater amount couldn't hurt. But we needed more RAM even before *Windows 95* arrived. Additional RAM gave us high hopes for improved performance, opening more programs, editing large graphics files, etc.

RAM Converters							
Supplier	30-to-72-Pin SIMM (4 to 1)	30- to 72-Pin SIMM (8 to 1)	30- to 30-Pin SIMM (4 to 1)	72- to 72-Pin SIMM (2 to 1)	1M DIP to 72-Pin SIMM	30-Pin SIP to 30-Pin SIMM	30-Pin SIMM to 32-Pin SIPP
Autotime	o						
Cameleon Technology	o		o	o			
Memory Conversion Prods.	o	o		o	o	o	o
Sermax Corp.	o			o			
SimmSaver Technology	o	o	o	o			
Tucson Computer Corp.	o						

In this section, I tell you what you need to know about RAM. I cover the varieties of RAM, DRAM upgrades, new technologies, pricing and other items of interest. I also include a list of companies that sell RAM through mail-order outlets. You'll find it in the RAM Suppliers table so that you know where to purchase RAM when you decide you need more.

• ***Varieties.*** There are several varieties of RAM, each designed to work in a different area of your system. Dynamic RAM, or DRAM, is used as system memory in both desktop and portable PCs. Static RAM, or SRAM, is used as the second-level cache on a motherboard. Video RAM, or VRAM, is used on video adapters. Outside the system unit, DRAM is also used to expand printer memory.

Within the DRAM and SRAM categories, there are also quite a few varieties. Some of these are: standard DRAM, EDO DRAM, burst EDO DRAM, standard SRAM and pipelined burst SRAM.

• ***DRAM Upgrades.*** DRAMs come in a variety of packages, including DIPs, SIPPs and SIMMs (Fig. 2). SIMMs are currently the most popular and have many flavors, including 30-pin (with two, three or nine chips) and 72-pin versions. SRAMs generally come in DIP format.

DIPs are individual chips that have pins located on either side of the chip body that plug into DIP sockets on the motherboard. SIPPs are modules equipped with a single line of discrete pins that plug into plated holes (SIPP sockets) on the motherboard. SIMMs are printed-circuit modules that have gold "fingers" and are typically placed in their connectors at an angle and then rotated to vertical, where they snap into place.

When you decide to upgrade RAM, it's important for you to purchase new modules that have the same packaging as the ones already in your system. If you have 30-pin modules in your system, you must purchase 30-pin modules when you upgrade, unless you also have 72-pin connectors on your motherboard. If the 30-pin module has two chips, your motherboard doesn't employ parity and uses only eight bits with four bits per chip. If the 30-pin module has three chips, your motherboard does employ parity and uses eight bits plus one parity bit with four bits each on two chips, one bit on the third chip. If nine chips are on the modules, your motherboard employs parity, using eight bits plus one parity bit with one bit per chip.

If you try to plug a two-chip SIMM into a socket on a motherboard that requires parity, you'll get a parity error on boot-up and your system will shut down. If you use a three-chip module in a system that doesn't use parity, the module should work okay.

Many different variations in chip count exist for 72-pin modules. The 4M module I have in my system has 12 chips, eight on one side and four on the other. This is effectively four sets of three chips per set on a single module. This is a 1M X 9 SIMM and, thus, has parity.

Besides packaging, you must be concerned with capacity and speed. SIMMs currently come in 1M, 4M, 8M, 32M and 64M capacities. Larger-capacity modules (128M and 256M) aren't available yet, but companies like Micron, IBM, Toshiba, Siemens, Mitsubishi and others are working on them.

As far as speed goes, DRAM modules available today are typically rated at 80, 70 and 60 ns. The speed to select is the one that matches the speed of the modules currently in your system. If you purchase a new motherboard, find out the speed of the DRAM recommended for the particular motherboard you get.

The number of SIMM connectors on a motherboard plays a major role in determining how efficiently and cost-effectively you'll be able to upgrade the memory in your system. Consider this case study of upgrading an Amerigo 486/66 from 4M to 8M. This system uses an IBM Blue Lightning motherboard that has four 30-pin SIMM connectors. It came with 4M of RAM on four 1M modules, which fill all the connectors. To upgrade to 8M, I had to purchase two 4M modules, rather than one (a cost of $320, instead of $160 at the time). I removed all four 1M SIMMs and replaced them with two 4M SIMMs. Now I have 8M of system RAM and 4M to use in another system or sell.

I could have kept two of the 1M modules in the system, but I plan to eventually add two more 4M modules, for a total of 16M. If I wanted more total RAM, I'd have to purchase larger-capacity SIMM modules, for example, 8M ones. But since this is a 486/66 system, I don't want to spend too much money on additional RAM.

Notice that I had to add two 30-pin SIMMs of the same capacity when I upgraded memory. This is typical of most systems that use either 30- or 72-pin SIMMs. The function of each pin of an IBM 72-pin SIMM are given in the Pinouts for 72-Pin SIMM DRAM Module table.

When you read the ads for memory, you'll find that suppliers usually list the number of pins, organization and speed of memory. A listing for a 30-pin SIMM module might look like this:

30-Pin SIMM Modules
4MBX9 80 ns (3 chip) $139

This tells you the module is a 30-pin

(Continued on page 89)

By Hardin Brothers

Introducing...*Java*!

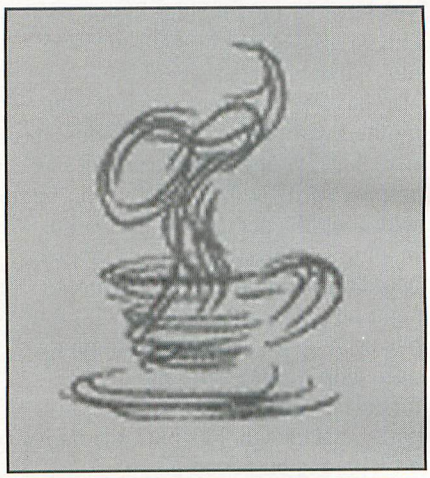
An exciting programming language that can change the image of computing and add a whole new dimension to using the Internet

For many people, the World Wide Web is the Internet. Its combination of text and graphics, its vastness, the hypertext links leading from one location to another, its billions of bytes and millions of programs to download seem like a nirvana of computing. After all, almost any Internet service can be performed with the newest Web browsers, and anything forgotten in this version will certainly be added to the next.

Even though the Web has been part of the Internet for more than five years, it was a small, barely-noticed service until the National Center for Supercomputer Applications (NCSA) released *Mosaic*, a graphical Web interface. Of course, *Mosaic* is now only one of many Web browsers, and neither the most powerful nor the most popular.

Despite the explosion of interest in the Web and the popularity of Web browsers, there's a lot of dissatisfaction in the Web and the way it presents information. After the glitter wears off, most users realize that the Web isn't much more than a huge stack of fancy brochures. Some sites have great graphics and terrific layout, while others are amateurish in both style and content. But there's little you can do with the Web except enjoy the brochure pages and, perhaps, use your browser to read mail and news and download shareware.

The foregoing is about to change. In its next incarnation, the Web will become as interactive as any application on your computer. There's no doubt about this, but there's still some question about what tools will provide the interactivity. Most of the Internet community seems to be betting on a new tool from Sun Microsystems called *Java*.



Sun's animated logo for *Java*. The steam rising from the cup is constantly in motion.

Uniquely *Java*

Java could be described as JAPL or "just another programming language," one of many that have appeared and often disappeared over the last 30 years. But *Java* has some advantages that other languages haven't, especially on the World Wide Web.

First, even though it predates the Web, *Java* has been developed from the beginning to write applications that can run on multiple platforms without changes. With the appropriate tools, it's possible to create and test a *Java* application on a Sun workstation in California and then run it on a Pentium PC in Maine or a Macintosh in Michigan, without having to make any changes. Unlike languages that require porting from one computer to another or at least re-compiling to run on a different computer and operating system, *Java* is completely portable.

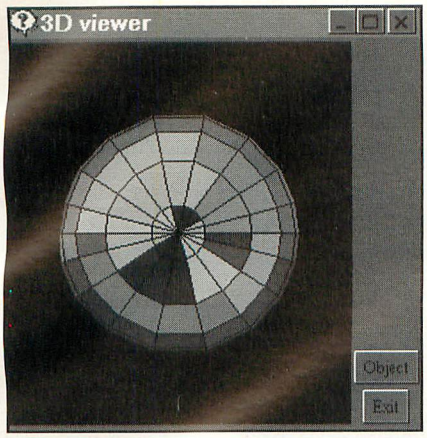
Its portability means that *Java* can be used to distribute applications across the Internet. It also means that it can be used for distributed computing on any network, even an office LAN. Distributed computing has always been an easy dream and a difficult reality. But with *Java*, it isn't too difficult to have a server, for example, distribute parts of a large computing task to idle computers anywhere on the network.

To create to ensure this portability, *Java* programs are written for a virtual computer—one that doesn't exist anywhere. Each computer that runs a *Java* program must have a *Java* interpreter, a program that converts instructions for the virtual computer into native instructions. *Java* isn't the first language that has taken this virtual-machine approach to portability, but it's one of the most successful at overcoming the inherent inefficiencies of running interpreted programs.

Java is also robust. The *Java* language, the compiler and the run-time interpreter are all designed to make sure that *Java* programs are well-behaved. Nothing can prevent bugs from interfering with the behavior of an application, of course. But *Java* applications can't interfere with other programs running on the same computer, nor can they crash the underlying operating system.

Java's robustness is derived, in large part, from two underlying characteristics. First, even though *Java* is similar to the C and C++ programming languages, it doesn't give programmers access to pointers. In C/C++ programs, errors with pointers often lead to the bugs that cause crashes. Second, *Java* has built-in memory management and array bounds checking, which are other areas of catastrophic errors in C and C++ programs.

On top of its robustness, *Java* is designed to be secure. Its robustness protects the host machine from unin-



An applet for viewing three-dimensional objects.

tentional errors. Built-in safeguards also protect against intentional errors and viruses. For many people, security is the number-one issue, especially because the Internet and other networks have a long history of passing along viruses, Trojan horses and other forms of mischief.

Java's security is based on operation of both the compiler and the interpreter. When the interpreter receives a *Java* program to execute, it first verifies that the code is correct and that it hasn't been changed since it was compiled. Then the interpreter carefully allocates memory for the application and places severe restrictions on how the program can access the computer's resources, especially its file system.

It will take a while to test *Java*'s security and convince system administrators and some users that it's impossible to spread a virus via a *Java* application. But since security is built into the very foundation of *Java*, many observers expect that it will pass the necessary tests and be accepted by most Internet users.

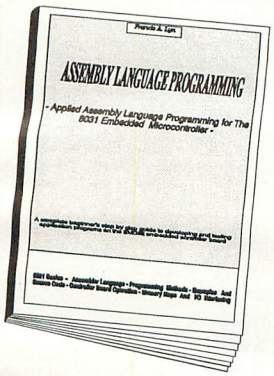
Like most modern languages, *Java* is object-oriented. It's similar to C++ and has also drawn from other object-oriented languages like *SmallTalk*, *Eiffel* and *Objective C*. For most programmers, especially those who are already familiar with C++, *Java* is very easy to learn and use. Because it allows inheritance, code modules, called classes, can be reused in both static and dynamic fashion. This means that *Java* programs can load and link to existing applications and execution units.

On the Web, new types of files appear frequently. Traditionally, when you come across a new file type, you then have to search for a helper application that will display the file for your Web browser. A *Java*-based Web browser could simply ask the server with the file for a *Java* class that can handle the file and then could load the *Java* class and file together, without any interference by the user.

In the past, portable virtual-machine languages have been relatively slow because of the extra work they must do to read and interpret a program. *Java* uses several advanced techniques to work almost as efficiently as native-code programs.

It has built-in multithreading, which

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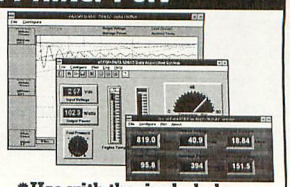
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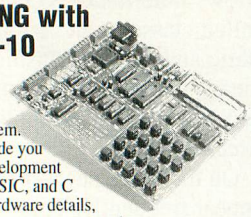
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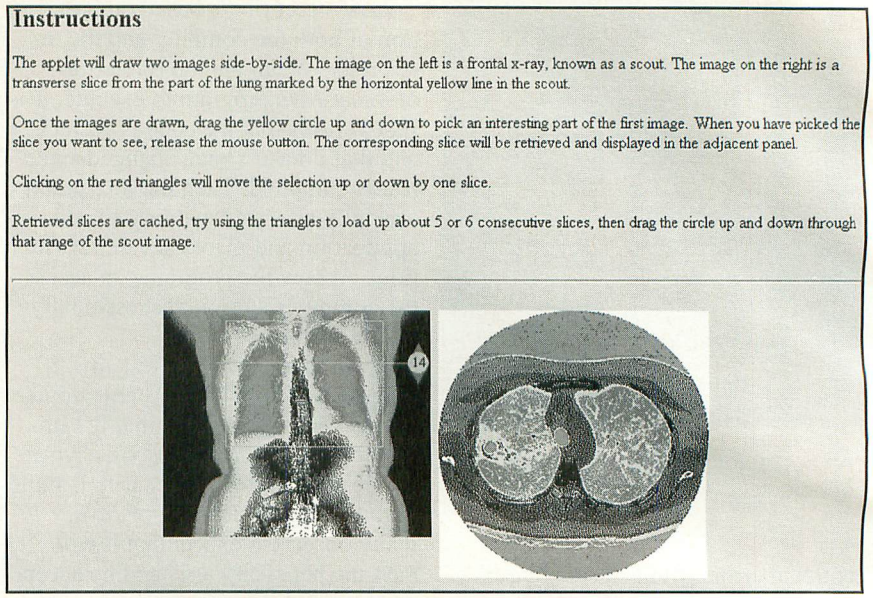
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An applet that shows how *Java* can be used for medical research and education.

means that it uses computer idle time for the memory-management and general system-maintenance operations that make many interpreted languages seem slow. Since *Java* programs are compiled to a byte code that's close to many machine instruction sets, programs can be easily and quickly interpreted. And if a *Java* application still isn't fast enough or if it must react with its environment in realtime, it can be compiled by the *Java* interpreter at run time into native machine code for fastest possible execution.

Java and the Web

A language for distributed computing will not necessarily become the next great innovation on the Internet. What has made *Java* popular and exciting on the Web is a program called *HotJava*.

HotJava is a Web browser, much like *Netscape* or *Mosaic*. Built into *HotJava* is a *Java* interpreter. If you use *HotJava*, you can run *Java* programs, called apps or applets, as you surf the Web. These applets are the first *Java* programs to be widely distributed.

Sun has also release a *Java Development Kit* so that anyone who has Web or FTP access can download the tools necessary to start writing *Java* programs. The source code for many applets is available on the Web. Developers of the first Web-based applets are sharing *Java* code so that

Internet Sources of Java Information

Newsgroups

alt.www.hotjava has general discussions about *Java* development and *Java*-based browsers.

comp.lang.java is dedicated to discussions about writing applications and applets in *Java*.

FTP

ftp://java.sun.com has the complete *Java Developer's Kit*, documentation and other information. Since it's often heavily loaded, you might want to use one of the many mirror sites. The most popular US ones are:

ftp:// www.blackdown.org
ftp://java.dnx.com
ftp://fpt.science.wayne.edu
ftp://sunsite.unc.edu

World-Wide Web

http://java.sun.com is Sun's home page for *Java* information and news. It has links that lead to everything from lists of applets, documentation for the *Java* language, the *Java Developer's Kit*, and *Java*-based browsers. If you're interested in *Java*, you should start on this page.

http://www.gamelan.com is a directory and registry of *Java* resources. It has the most up-to-date list of *Java* applets on the Web. As of this writing, it lists 454 *Java* applets in 18 categories that range from Animation (40 entries) to Special Effects (81 entries) and Utilities (27 entries).

Some Demonstration Applets Developed at Sun:

(Most have source code available)

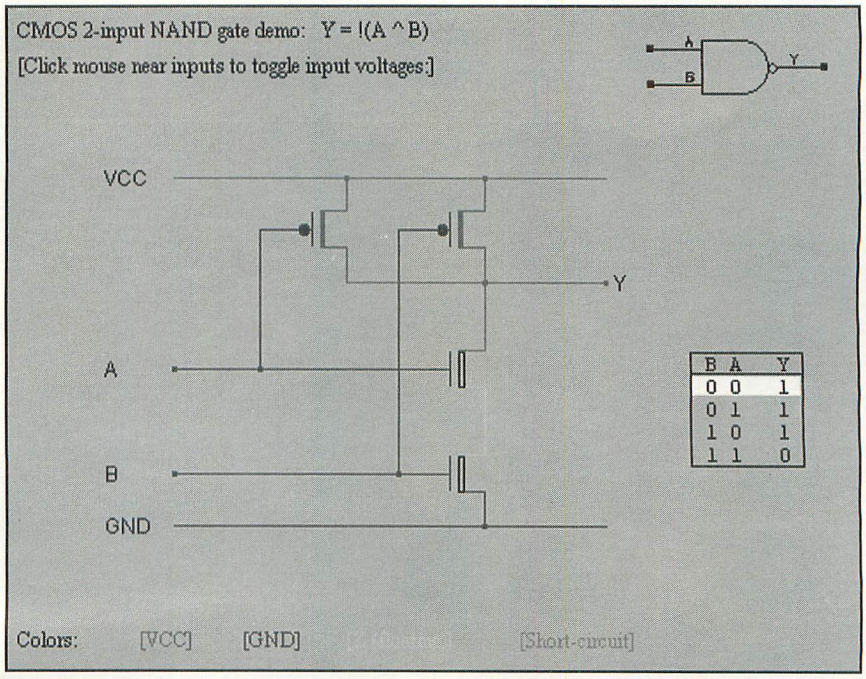
The Financial Portfolio Demo Page
Games and Other Diversions:
- Hangman
- Catch the Jumping Box
- Tic Tac Toe
- Multilingual Word Match Game

Applets to Spice up a Web Page:
- Bubbles
- ImageLoop, the Original Animation Applet
- A Sound Player
- A General-Purpose Animator
- Blinking Text
- Bouncing Heads
- An Animated "Under Construction" Sign (with audio)
- Scrolling Images
- Tumbling Duke
- Live Feedback ImageMap
- A Simple 3D Model Viewer

Educational Applets:
- 3D Chemical Models
- Fractal Figures
- Animated Sorting Algorithms

Utilities:
- A Clock
- A Simple Spreadsheet
- A Simple Bar Chart Applet
- GraphLayout

For Programmers Only:
- ArcTest
- CardTest
- DitherTest
- DrawTest
- GraphicsTest
- ImageTest
- SimpleGraph



A CMOS NAND gate demonstration in a *Java* applet. The user can modify the two inputs with a mouse.

they, and you, can learn to use it better. In addition, two *Java* news groups provide information about the language and tips on using it.

Sun Microsystems seemed to realize that a couple dozen applets that require a new browser weren't enough to make *Java* popular. So they licensed the code for *HotJava* to *Netscape*, which has included a *Java* interpreter in its Version 2 browser. Sun's own browser, *HotJava*, has been eclipsed by the beta versions of *Netscape* 2.0, with its built-in *Java* interpreter. Ironically, as of this writing, if you use *HotJava*, you're limited to viewing applets created with the alpha release of the *Java Development Kit* (*JDK*). If you use *Netscape*, you're limited to viewing applets created with the beta version of the *JDK*.

As more and more of the alpha applets are replaced by versions written with the beta kit, users seem to be ignoring *HotJava* itself and turning to *Netscape* for an applet viewer.

In addition to *Netscape*, several other major companies have licensed *Java*:

IBM plans to use *Java* in its own web browsers and servers, which are in development. It also says that it will include *Java* technology in a future version of *Lotus Notes*, its integrated messaging and groupware software. In addition, IBM has announced plans to include *Java* in future releases of its AIX and OS/2 operating systems.

Adobe Systems has licensed Java to *include* in its *PageMill* Web-authoring program and *Acrobat* electronic document software.

Borland is working on a Delphi-like tool for programming *Java* applets and applications.

Metroworks, a major supplier of Macintosh programming tools, has licensed *Java* to include in its *Code Warrior* product.

Silicon Graphics and Macromedia plan to use *Java* as the basis for a new set of Open3D and Multimedia interfaces to the World Wide Web.

Spyglass Inc. plans to add a *Java* interpreter to its *Spyglass Mosaic* Web browsers.

Oracle Corp. says it will combine *Java* technology with its Network Loadable Objects application framework.

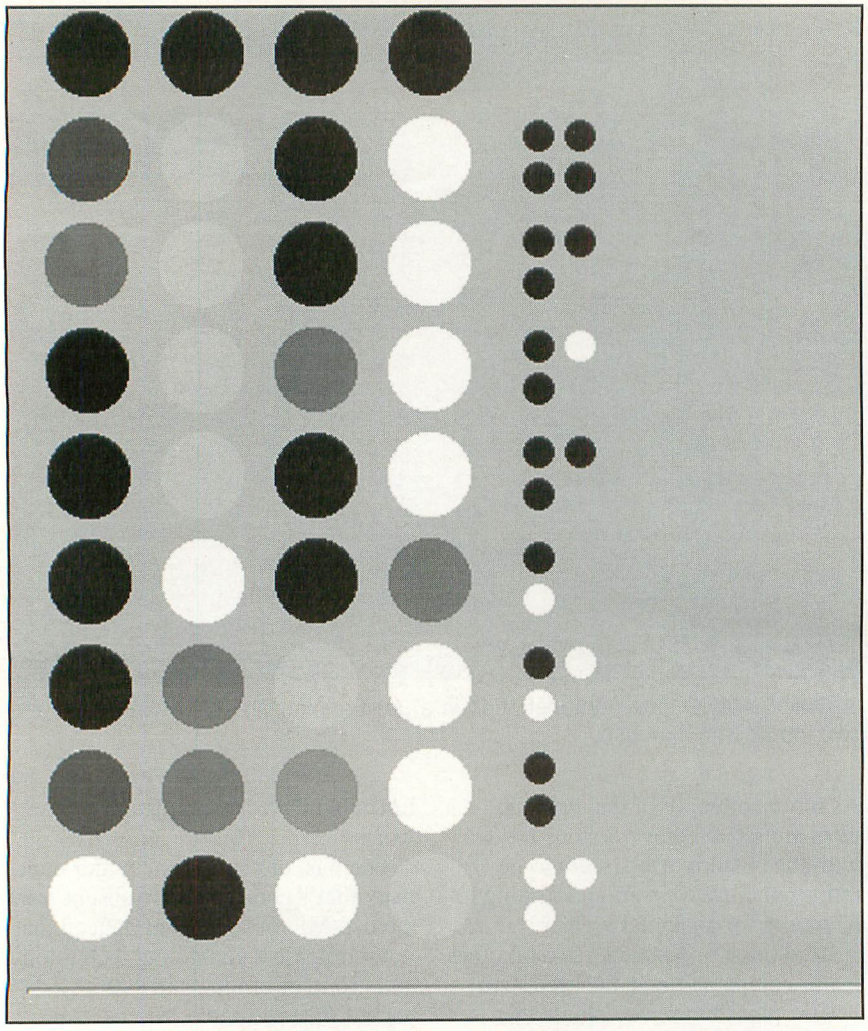
There is, of course, one major company that's conspicuously absent from the list. Microsoft has announced that it will release a competing technology and group of products in 1996. Code-named *Blackbird*, the Microsoft product will initially be based on Visual C++, with a *Visual Basic* version available later.

On the day I was finishing this article, Sun announced that Microsoft had signed a letter of intent to also license *Java* technology. According to Sun, Microsoft will add *Java* to its Web browser and also add a *Java* interpreter to the Explorer in *Windows 95*.

Microsoft will also improve the *Windows 95* port of *Java* and will share its implementation with Sun, which will be free to distribute the port to its customers.

Getting Started

The world of *Java* in particular, and the World Wide Web in general, is changing almost every day. By the time you read this, there may be dozens of new developments to report. The best place to look for news is on Sun's *Java*-based Web pages. Start by pointing your browser to http://java.sun.com and follow the links to the information you need.



A simple color matching game, similar to MasterMind, implemented as a *Java* applet.

If you want to simply enjoy *Java*-based interactive elements of the Internet, all you need is a *Java*-compatible browser. As I write this, the only one available is Netscape's 2 beta browser. Only the versions for *Windows NT*, *Windows 95* and Sun *Solaris* contain the *Java* interpreter. *Java*-based browsers for other platforms, including *Windows* 3.1 and 3.11 and the Macintosh should be available by the time you read this.

If you want to write *Java* applications for any network or *Java* applets for the World Wide Web, the best place to start right now is with Sun's *JDK*, which is also available for downloading. In addition to the development kit, you'll almost certainly want to look at source code for existing applets. The *Java* home page points to a wide variety of applets.

If you're an experienced C++ programmer, *Java* won't be difficult to learn. It was designed to be easy (a relative term, to be sure) and it is. In fact, easier to learn than C++ because of the features that have been purposely omitted. *Java* doesn't have typedefs, defines or a preprocessor to worry about. Nor does it have structures or unions, functions, a GOTO statement, operator overloading or pointers. And because *Java* manages memory, including garbage collection, for you, you don't have to worry about claiming and releasing memory.

A *Java* program is made up of objects that are defined by classes. The objects interact by passing messages back and forth. New objects can be defined by extending other objects, *Java*'s term for inheritance. Messages can be sent to objects that are stored anywhere, even in different locations on a company network or even on the Internet.

It's this last feature, *Java*'s form of dynamic binding, that turns *Java* into a true network-based language. If all of the objects are on your computer, *Java* has the much the same power and flexibility as other object-oriented languages. But once it starts using objects or classes that are stored in different locations, *Java* opens up a world of truly share-able code modules.

Java's Future

Whether *Java*, Microsoft's *Blackbird* or a yet-to-be-invented language becomes the prevailing standard, the Internet and computing in general are about to change radically. With download-able and share-able code modules, the computers of the Internet become a single vast, interactive com- puter.

So far, the Internet has been a means of sharing information but all of the necessary functionality has to be stored on each individual computer. Your computer has to know how to get data on the Web and it has to know how to display the information you find. The promise of *Java* technology will change this. Because the software and data can be combined, developers can let their imaginations run wild.

The first applets, of course, are mostly toys. Many are animations added to static Web pages, because it's much faster to let your computer run a *Java* animation instead of downloading animation frame by frame to view statically. But there's already talk of "renting" full-fledged *Java* applications to end users who need, say, a CAD program for an hour or a day. Eventually, say the dreamers, *Java* or something like it could do away with most of the applications that are now loaded into our computers. Instead of buying software, we'll just load up *Java*, browse the Web and find the functionality we need.

Late-Breaking News

Just as I finished writing this article, Sun and Netscape announced plans to jointly develop a new, open scripting language called *JavaScript*. The product will be aimed at non-programmers who wish to create Web pages that use *Java* applets. According to the announcement, 28 leading technology companies, including Microsoft, expressed endorsement of *JavaScript*. ■

By Thomas R. Fox

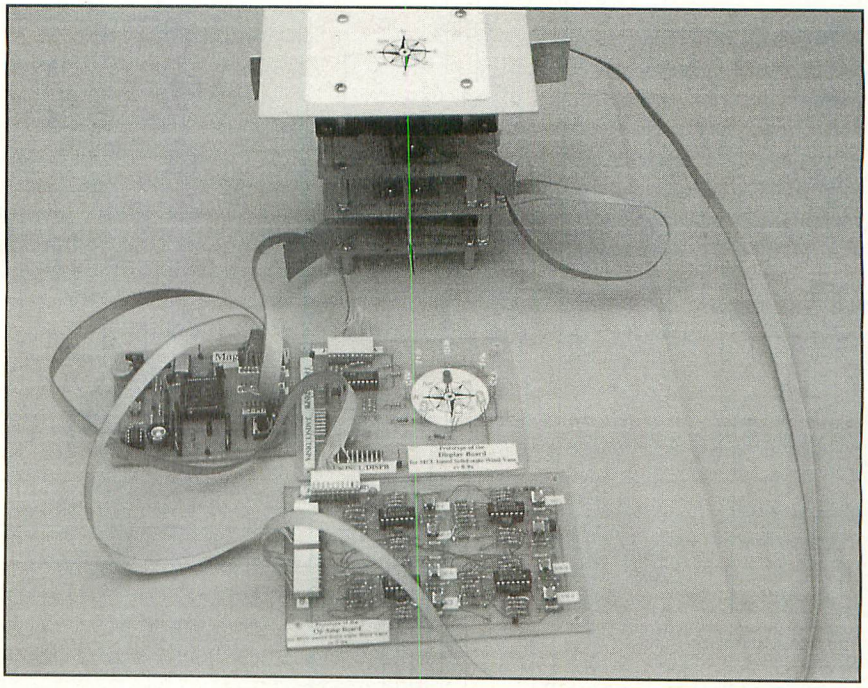
A 68HC11 EEPROM Programmer/Mini-Development System

Part 3

An MCU-based Solid-State Wind Vane

In Part 1 of this series, I detailed how to build an EEPROM Programmer that can double as a basic development system. Then in Part 2, I focused on a simple HCx11-based Controller Board. In this third part, I describe a Solid-State Wind Vane that makes use of the previous two projects. The Solid-State Wind Vane basically polls eight sensors, selects the one that's at the highest temperature and displays its direction on a circular LED array that corresponds to points on the compass.

The Sensor Assembly consists of one windbreak and two sensors on each of four vertically stacked simple circuit-board assemblies. The referenced sensor is on the leeward side of the windbreak. For instance, the North sensor is on the "south" side of the windbreak. With this arrangement, a wind coming from the north causes the North sensor (on the south side) to be warmest (the sensors are internally heated). The plane of the windbreak on the N-S board is at right angles to the windbreak on the E-W board. Similarly, the plane of the windbreak of the NE-SW board is at right angles to the NW-SE board, and the plane of the windbreak of the N-S board is at a 45° to the plane of the windbreak of the NE-SW board.



Circuit Description

The Solid-State Wind Vane consists of four basic subassemblies. I'll describe each in turn.

• ***Sensor Assembly.*** The heart of the Solid-State Wind Vane, the Sensor Assembly shown at the lower-left in Fig. 1 collects all the data needed to determine wind direction. If the eight separate outputs of these devices are connected to eight accurate voltmeters, a skilled observer can determine which way the wind is blowing. Use of the HCx11 eliminates the need for a skilled human observer.

The Sensor Assembly consists of four printed-circuit subassemblies. Any of National Semiconductor's LM135/235/335 series temperature sensors can be used here. While this temperature sensor is an IC, it functions as a zener diode with a breakdown voltage that's directly proportional to the absolute temperature at +10 mV/°K. (Degrees Kelvin is roughly equal to 273° + °Celsius. Thus, 25° C = 298° K.)

At room temperature (298° K), the breakdown voltage of an LM135 should be at 2.98 volts. For the premium LM135AH, it's guaranteed to be between 2.97 and 2.99 volts. However, for the less-expensive garden-variety LM335Z, National guarantees only that it's somewhere between 2.92 and 3.04 volts. The specifications for the other grades lie between

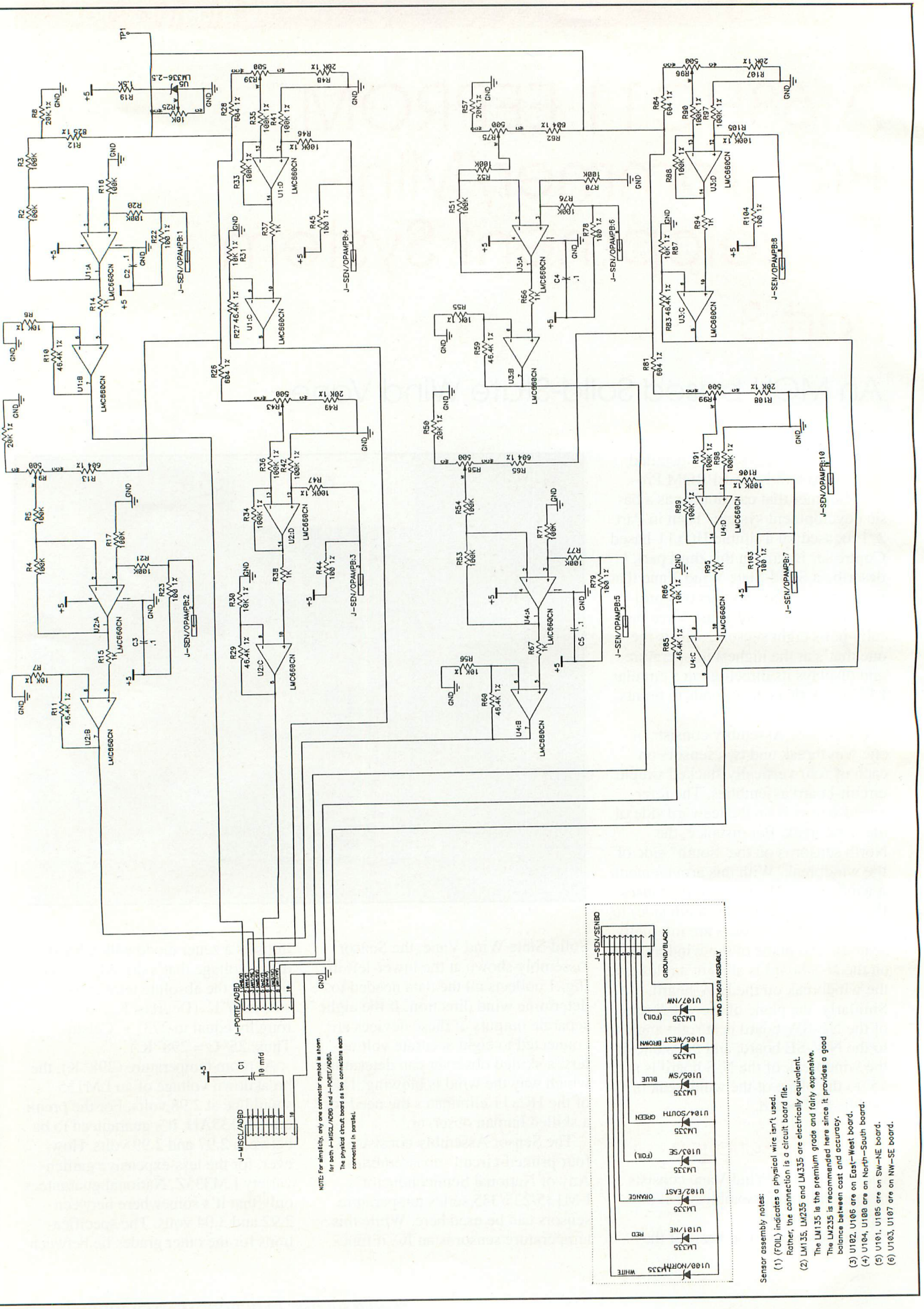

J-SEN/SENBD
GROUND/BLACK
WIND SENSOR ASSEMBLY
U107/NW
LM335
(FOIL)
U106/WEST
BROWN
U105/SW
BLUE
U104/SOUTH
GREEN
U103/SE
(FOIL)
U102/EAST
ORANGE
U101/NE
RED
U100/NORTH
WHITE
J-PORTE/ADBD
J-MISCL/ADBD
J-SEN/OPAMPB:1
J-SEN/OPAMPB:2
J-SEN/OPAMPB:3
J-SEN/OPAMPB:4
J-SEN/OPAMPB:5
J-SEN/OPAMPB:6
J-SEN/OPAMPB:7
J-SEN/OPAMPB:8
J-SEN/OPAMPB:10
LM336-2.5
LMC660CN
NOTE: For simplicity, only one connector symbol is shown for both J-MISCL/ADBD and J-PORTE/ADBD. The physical circuit board as two connectors each connected in parallel.
Sensor assembly notes:
(1) (FOIL) indicates a physical wire isn't used. Rather, the connection is a circuit board file.
(2) LM135, LM235 and LM335 are electrically equivalent. The LM135 is the premium grade and fairly expensive. The LM235 is recommended here since it provides a good balance between cost and accuracy.
(3) U102, U106 are on East–West board.
(4) U104, U108 are on North–South board.
(5) U101, U105 are on SW–NE board.
(6) U103, U107 are on NW–SE board.

Fig. 1. Schematic diagram of Op-Amp Board circuitry.

these extremes. Even though the Op-Amp Board uses potentiometers to calibrate out this temperature error, the higher the quality of the sensor used, the more reliable the Wind Vane will be.

When measuring absolute air temperature, internal heating caused by the reverse current of the sensor isn't desirable. Thus, the LM135 is generally operated at or less than 1 mA. However, since in this application internal heating *is* desirable, the sensor is operated at a current slightly beyond its maximum rating of 15 mA.

Four windbreaks are arranged so that any one is at 45° angles with respect to those flanking them. Two sensors are used per windbreak. Because of internal heating, the sensor on the leeward side of the windbreak is warmest. Since each windbreak is at a different angular position, one sensor should be warmest, with the two adjacent sensors only slightly cooler than it. The other sensors should be substantially cooler when a wind is blowing.

To protect it from the sun, rain and snow, the Sensor Assembly should have a "roof" over it. Even a moderately large roof won't protect the sensors from wind-driven rain or snow. This should have no effect on accuracy, though, and it just might increase accuracy because rain or snow will cool the sensors exposed to the wind much more than the ones on the leeward side of the windbreaks. However, direct sunlight striking a sensor can throw off the Solid-State Wind Vane's accuracy.

• ***Op-Amp Board.*** This board provides signal conditioning to permit you to make full use of the HCx11's A/D converter. It also provides a means for compensating for variations in sensors. While Fig. 1 appears to be complex, it's really basically simple. There are eight separate sensors in this project, which means that a circuit is needed for each sensor. As you can see, Fig. 1 comprises eight basically identical circuits.

LM336-2.5 *U5* provides the stable 2.5-volt reference for all eight circuits. Seven of these circuits are identical and have adjustable outputs. The

PARTS LIST

Sensor Assembly

Semiconductors

U1 thru U7—National Semiconductor LM135, LM235 or LM335 series Precision Temperature Sensor (see text)

Miscellaneous

Printed-circuit boards (see text); J-SEN/Assembly—10-pin male header with contacts on 0.1" centers, pin 9 removed, right-angle type recommended (Mouser Cat. No. 538-22-05-2101); 1" threaded metal spacers for 6-32 hardware; 18" X 18" 20-gauge sheet metal for roof (see text); four 10" X 7/8" hardwood dowels (see text); hookup wire with seven different color insulation (see text); etc.

Op-Amp Board

Semiconductors

U1 thru U4—LMC660CN CMOS operational amplifier

U5—LM336-2.5 voltage reference

Capacitors

C1—10-µF, 20-volt electrolytic

C2 thru C5—0.1-µF, 50-volt ceramic

Resistors (1/4-watt, 1% tolerance. Some resistor designations in numerical sequence are not assigned.)

R1,R8,R48,R49,R50,R57,R107,R108—20,000 ohms

R2 thru R5,R16,R17,R20,R21,R33 thru R36,R41,R42,R46,R47,R51 thru R54,R70,R71,R76,R77,R88 thru R91,R98,R105,R106—10,000 ohms

R6,R7,R30,R31,R55,R56,R86,R87—10,000 ohms

R10,R11,R27,R29,R59,R60,R83-R85—46,400 ohms

R12—825 ohms

R13,R26,R28,R62,R65,R81,R84—604 ohms

R14,R15,R37,R38,R66,R67,R94,R95—1,000 ohms

R19—1,500 ohms

R22,R23,R44,R45,R78,R79,R103,R104—100 ohms

R9,R39,R43,R58,R75,R96,R99—500-ohm, miniature potentiometer (Digi-Key Cat. No. D4AA52 or Mouser Electronics Cat. No. 594-63M500)

R25—10,000-ohm miniature potentiometer (Digi-Key Cat. No. D4AA14 or Mouser Electronics Cat. No. 594-63M103)

Miscellaneous

Printed-circuit board (see text); machine hardware; etc.

Display Board

LED1,LED9—Red super-bright light-emitting diode

LED2,LED4,LED6,LED8—Yellow super-bright light-emitting diode

LED3,LED5,LED7—Green super-bright light-emitting diode

U1—74LS42 CMOS BCD-to-decimal decoder

Capacitors

C1—10-µF, 20-volt electrolytic

C2—0.1-µF monolithic ceramic

Resistors (1/4-watt, 5% tolerance)

R1 thru R9—1,000 ohms

R10 thru R13—10,000 ohms

Miscellaneous

J-MISCL/DISPA,J-MISCL/DISPB, J-POTRB/DISPA,J-PORTB/DISPB—10-pin male header with contacts on 0.1" centers, one pin removed, preferably right-angle type (Mouser Electronics Cat. No. 538-22-05-2101)

Printed -circuit board; machine hard ware; solder; etc.

Note: The following items are available from Magicland, 4380 S. Gordon Ave., Newaygo, MI 49412:

Op Amp Board—Bare pc board with plated-through holes, $10 (OPAMP1A-BRD); complete kit of parts, including pc board, $35 (OPAMP1A-KIT).

Display Board—bare pc board, $8 (DISP1A-BRD); complete kit of parts, including pc board, $17 P(DISP1A-KIT).

Sensor Assembly—includes four pc boards, spacers, hardware, wire, connector but *not* sensors or windbreak, $25 (SENASSEM); set of four LM235H sensors, $20; set of four LM335Z sensors, $6. (Note: Wind Vane requires eight sensors, which can be either LM235H or LM335Z sensors. LM235H sensors, though more expensive, are recommended.)

Miscellaneous—spiral-bound manual that describes kit construction and use of MAGPRO-11, MAGTROLL-11 and Solid-State Wind Vane and contains more documentation than comes supplied with the kits, $7 (MAG95MAN); PC-compatible disk with all the software mentioned in this series of articles, $7.10 (MAGPROX-3DSK for 3 1/2" disk or MAGPROX-5DSK for 5 1/4" disk) (free with purchase of kit for MAGPRO-11 or MAGTROLL-11 See Parts 1 and 2 of this series.)

Also available is an MC68HC11A1FN that has its EEPROM programmed with WV_FINAL software, for $10 (HC11-WV FINAL).

Also available are limited quantities of the MC68HC811E2FN—*not* programmed—for $22 each. Refer to Part 2 for MAGTROLL-11 and MAGPRO-11 availability.

Please include $3 for shipping on all orders. Michigan residents, add 6% state sales tax. Deduct 10% for orders that exceed $100.

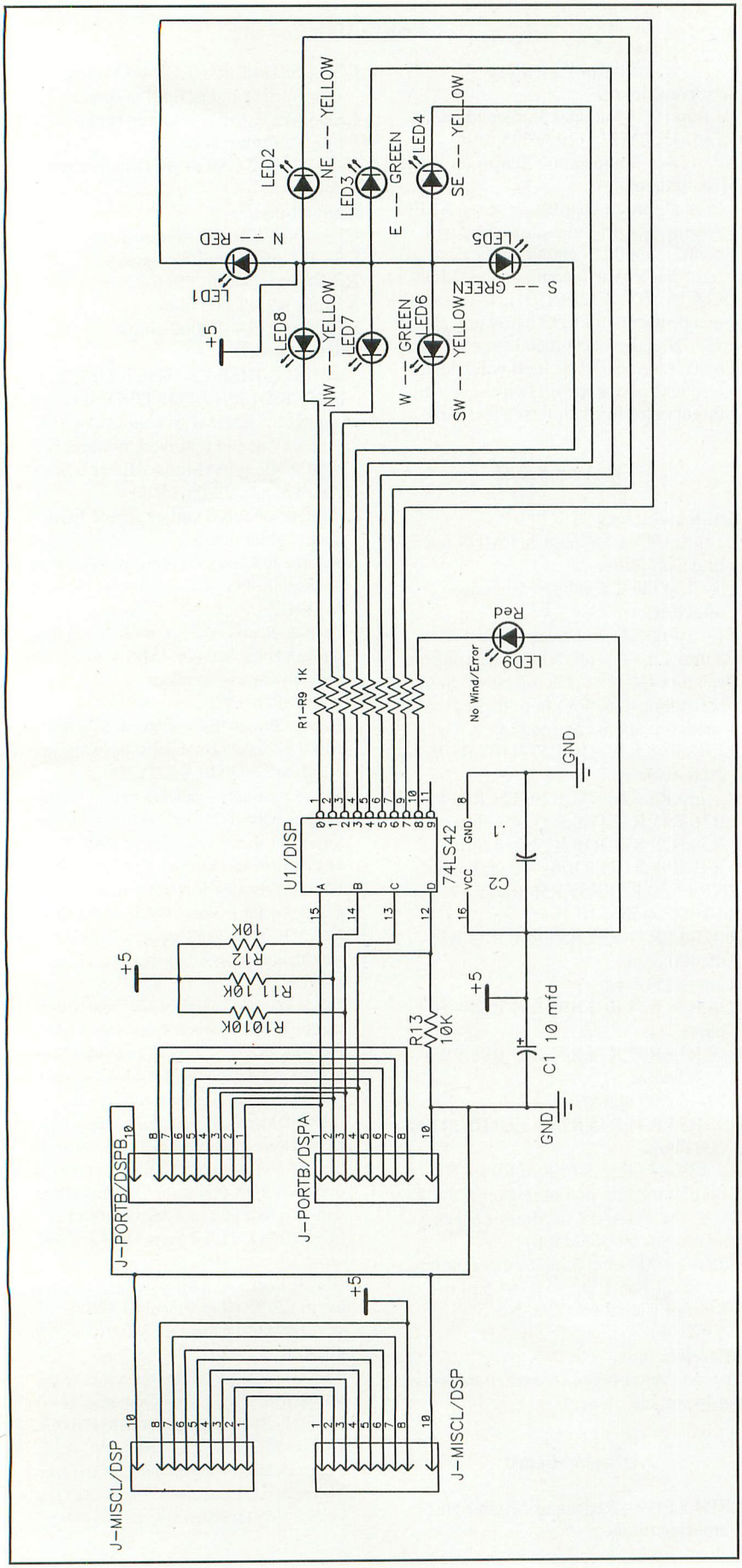


Fig. 2. Schematic diagram for Display Board circuitry.

eighth circuit, consisting of *U1A* and *U1B*, is slightly different because it lacks a potentiometer and, thus, doesn't have an adjustable output. During calibration, the *U1A*/*U1B* circuit is treated as the standard against which the other circuits are adjusted so that their outputs are identical to it when the air is calm.

Assume a North sensor temperature of about 80° F, (about 300° K). This is a good assumption when the air temperature is in the 60s and there's a moderate north wind. The North sensor is located on the south side of the windbreak. The output of this sensor is connected to pin 1 of J-SEN/OPAMPB:1. You can assume an input of 3.00 volts to pin 3 of differential amplifier *U1A*.

Using simple math ((20/20.825) X 2.5 = 2.4), you can see that the potential at the differential amplifier's inverting (–) input at pin 2 is 2.4 volts. From more simple math, you can see that the output of this differential amplifier is 0.6 volt (3 – 2.4).

The output from *U1A* appears at the noninverting (+) input of amplifier *U1B* at pin 5. Since *U1B* has a gain of 5.64, its output is 5.64 X 0.6 volt = 3.384 volts. This is transmitted to pin 1 of PORT E, which is the A/D converter input of the HCx11 located on the MAGTROLL-11 Controller Board. When the A/D converter converts this channel (AN0), it stores the hexadecimal number 0AD (173 decimal) at the ADDR1 register. The other seven circuits in Fig. 1 are similar to the *U1* circuit, except that each has a separate potentiometer for adjustment.

With the foregoing arrangement, it's obvious that some limitations exist. For instance, once the sensor is heated to about 130° F, the circuit becomes saturated, and the Wind Vane won't function properly. However, the Wind Vane should function at air temperatures up to 120° F, as long as there's at least a moderate wind. It also becomes apparent that at a sensor temperature of less than about –20° F (–29° C) another problem exists.

With the sensor internally heated, unless there's a strong wind, the Wind Vane will probably function down to an air temperature of around –35° F.

Since I haven't tested the project at these extremes, the limits I cite here are theoretical.

The Op-Amp Board uses National Semiconductor's LMC660CN quad CMOS operational amplifiers. The primary purpose for the choice of this particular device in this application is that it provides true single-supply operation. The inputs and outputs of this chip truly operate down to ground and up to the supply voltage. The popular (and inexpensive) LM324 promises this with a cursory reading of its data sheet, but it never quite lives up to its promise since it always remains roughly 20 mV above ground potential with a single supply. Even so, you can use an LM324 here and get the Wind Vane to work—at least at "normal" temperatures.

• ***Display Board.*** This simple board, the schematic diagram for which is shown in Fig. 2, consists of light-emitting diodes *LED1* through *LED9* and 74LS-42 BCD-to-decimal decoder *U1*.

Eight LEDs are physically arranged in a circle to approximate the appropriate north, northwest, west, southwest, south, southeast, east and northeast points of the compass. The ninth LED, located in the center of the circle formed by the other LEDs, indicates no wind, extremely high or low temperature or some other error condition.

The input of *U1* connects through connector J-PORTB to low-order nibble PB0 through PB3 of PORT B of the HCx11. To light a LED, simply store a number at PORT B. For instance, to light North *LED1*, store 07 at PORT B; to light West *LED6*, store 01 at PORT B; and so on.

• ***Controller Board*** (MAGTROLL-11). The MAGTROLL-11 Controller Board is about as simple as one can get. If you look at this board, all you really notice are the HCx11 chip and a bunch of connectors. The firmware on this board is contained in the HCx11's internal 512 bytes or HC811's 2K bytes of EEPROM. Of course, it's also possible to use MAGTROLL with its internal 8K ROM, although the problem in doing so is cost for small runs. For more details on MAGTROLL-11, refer to Part 2 of this series.

You can use other HCx11 controller boards in this project, as long as they have an eight-channel A/D converter and connectors to PORT E and PORT B. The MC68HC11A1P 48-pin DIP version of the HCx11 contains only a four-channel A/D converter and, thus, isn't suitable for use in this project.

It's also possible to use controller boards based on other MCUs. However, if you go this route, you're on his own because you'll have to write your own software routines from scratch.

Important Notice to MAGPRO-11 Users: Due to address conflicts, the destination address for the files to be initially downloaded to MAGPRO-11 (EEPROM programmer) should start at 2100h—not 2000h; the final address for HC11 MCUs should be 22FFh—not 21FFh; the final address for HC811 MCUs should be 28FFh—not 27FFh. Since the destination addresses have increased by 100h, the offset must decrease by 100h. Thus, for HC11s, the offset should be –9500h — not –9600h, while the offset for HC-811s should be –D700h—not –D800h.

Construction

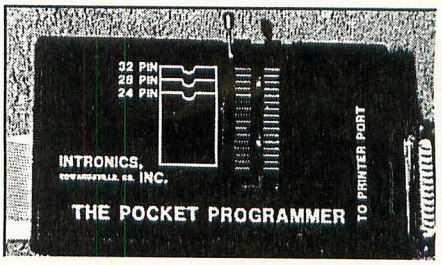
Although this project requires seven circuit-board assemblies and a power supply, it isn't as difficult to build as you might think. One assembly is the MAGTROLL-11 described in Part 2 of this series. Four ultra-simple circuit boards are needed for the Sensor Assembly. Also required are a single-sided Display Board and a double-sided Op-Amp Board.

• ***Sensor Assembly.*** This is the most-difficult part to build and, unless inexpensive LM335Z sensors are used, the most-expensive. There's more to construction of this assembly than merely stuffing a pc board with electronic components.

Use the Fig. 3 actual-size etching-and-drilling guides for the four Sensor circuit boards to fabricate the required pc boards. When the boards are ready, refer to the appropriate guide for each in Fig. 4 to wire the individual sub-assemblies.

There are four holes for each sensor, even though the sensors have only three leads and only two are actually used. I planned the layout of these boards to make it easy for you to insert either of two basic types of sensors—the inexpensive plastic-cased TO-92 with a Z suffix, as in LM335Z, and the metal-cased TO-56 with an H suffix, as in LM235H. I've discovered that the H-suffix metal-cased part performs better in this project.

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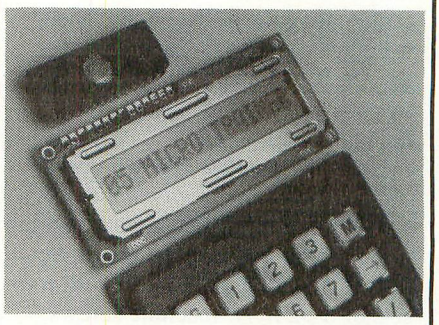
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When soldering, be sure to use a heat sink between your iron and the case of the sensor to avoid heat damage. Don't apply soldering heat for more than 5 seconds per sensor lead, and wait at least a minute between each soldering operation per sensor.

Use color-coded hookup wire for the connections from the Sensor Assembly to the rest of the circuitry. If possible, try to emulate the colors indicated in each view in Fig. 4. This way, you'll be able to keep things from becoming confusing.

The windbreaks needed for the Sensor Assembly must be custom-fabricated by you from 28-gauge or so sheet aluminum, which you can obtain from some building-supply stores and many hobby shops. Each windbreak takes about 10 minutes to make if you work slowly.

Details for fabricating the windbreaks are given in Fig. 5. There are three different versions of windbreaks. The North-South and East-West windbreaks are different from each other and the other two windbreaks. The Northeast-Southwest and Northwest-Southeast windbreaks are identical to each other.

After cutting the windbreaks to proper size and shape, drill the holes in their tabs as indicated. This done, carefully fold each windbreak down the center along the dashed lines. Then bend the four tabs on each so that they're perpendicular to the main portions of the windbreaks and drill a 9/64" hole through the center of each tab.

Carefully position one windbreak on its appropriate Sensor Assembly board, lining the holes in its mounting tabs with the holes in the board. Secure the windbreak in place with four sets of 6-32 X 1/4" machine screws, nuts and lockwashers. Repeat for all remaining windbreaks and boards.

Stack the Sensor Assembly boards vertically, with the NW-SE board on the bottom and N-S board on top, as illustrated in Fig. 6. Use 6-32 threaded spacers and No. 6 machine screws to secure together the board assemblies, base and top plate.

The top plate serves as a secondary roof—not the primary roof. Four spacers and screws mount the top plate to the N-S board, the middle two boards and the bottom NW-SE board to the large bottom plate. The other two boards require only two spacers and screws. If necessary, and if clearances permit, you can add one or two additional spacers and screws to increase strength. Also, you can add a nut or two to a spacer to increase clearances.

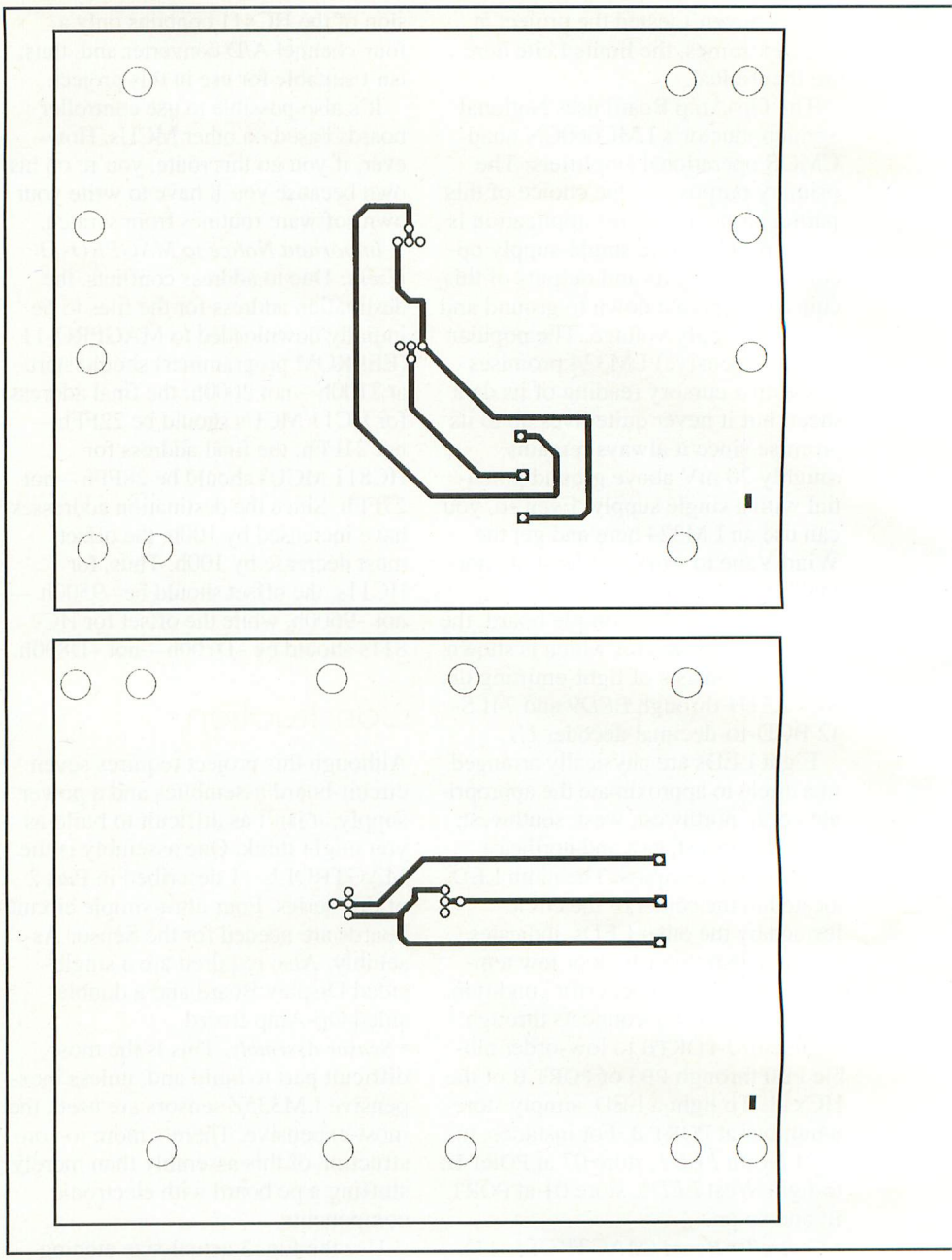


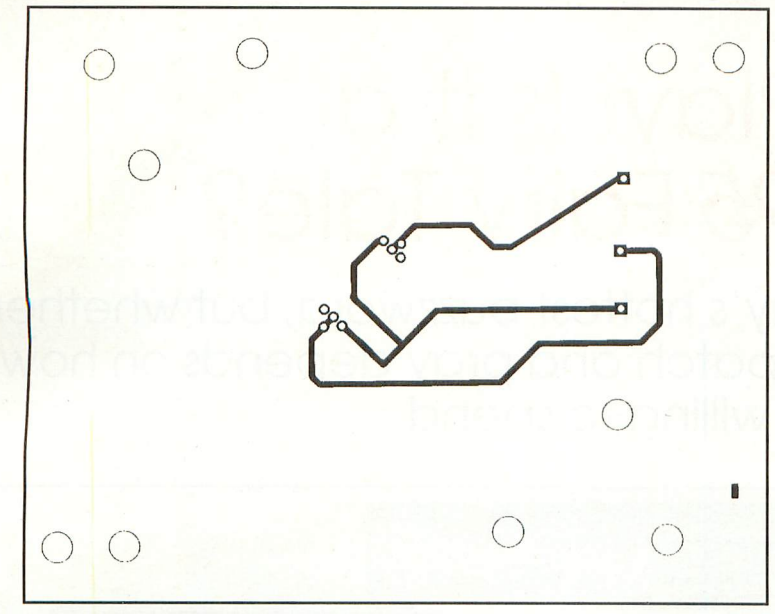
Fig. 3. Actual-size etching-and-drilling guides for Sensor Boards.

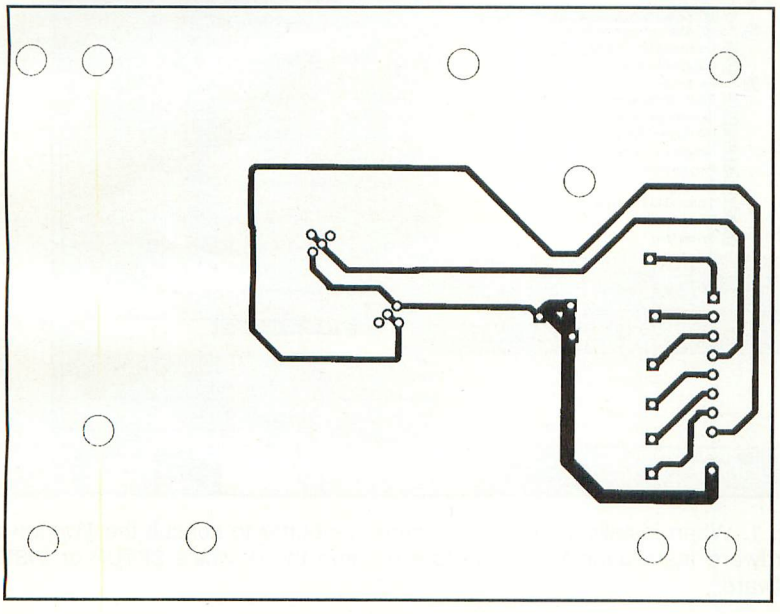
One possible way of mounting a roof over the Sensor Assembly is illustrated in Fig. 7. The roof itself is made from a piece of 18" X 18" moderately heavy sheet metal that you bend to form a curve. Don't use the lightweight 28-gauge aluminum sheet metal recommended for the windbreaks.

The top of the assembly shown in Fig. 6 is simply a printed-circuit blank from which all copper cladding has been completely etched. This can be considered the secondary roof.

Mount the sensor assembly to a 10" X 12" pc blank or sheet of phenolic. This base board is meant to be attached to a wood board before final mounting in its permanent location. The 7/8" wood dowels that support the assembly's roof also mount to this base board. A photo of the completed Sensor Assembly is shown in Fig. 8.

A semi-kit for the Sensor Assembly





is available from the source given in the Note at the end of the Parts List. It consists of the four pc boards, spacers, screws, nuts, color-coded wires and connector. Sensors are available separately in sets of four. Not included in this semi-kit are the windbreaks.

• ***Op-Amp Board.*** This board is double-sided. While you can fabricate your own board with the aid of the actual-size etching-and drilling guides given in Fig. 9, you probably won't be able to plate-through the holes where needed. Thus, it's a good idea to purchase a ready-to-wire board from the source given in the Note at the end of the Parts List.

Shown in Fig. 10 is the wiring guide for the Op-Amp Board. The Parts List specifies the value for potentiometers *R9*, *R39*, *R43*, *R58*, *R75*, *R96* and *R99* at 500 ohms. This value assumes the sensors will be either LM235H or LM335AZ. If you use the LM335Z instead, change the values of these potentiometers to 1,000 ohms. (If you seek perfection and choose the LM135AH, you probably can get away with 200-ohm potentiometers.)

• ***Display Board.*** This is a simple sin-

(Continued on page 94)

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By TJ Byers

Plug and Play: Is it a *Windows 95* Fairy Tale?

Plug and Play is today's hottest buzzword, but whether it's plug and pay or patch and pray depends on how much money you're willing to spend

Plug and Play is a term used to identify any hardware peripheral that plugs into your PC and instantly works the way it's supposed to. Sounds simple enough, doesn't it? Unless you're among the chosen few, though, it's more like plug and pray. For plug and play to work, you need a plug-and-play motherboard (typically Pentium-based), a plug-and-play BIOS and a plug-and-play software operating system, which currently consists of *Windows 95*—only.

In this three-tiered article, I focus on *Windows 95* and how it works with Plug and Play products. First, you'll find what to expect when you upgrade to *Windows 95* using your current non-Plug-and-Play hardware. Second, you'll discover what occurs when you mix Plug and Play with non-Plug-and-Play devices. Finally, you'll see how harmonious life can be if you throw good sense and lots of money to the wind and replace your existing system with a brand-new Plug and Play computer.

Before I get started, though, you have to understand that Plug and Play is a moving target. Not all of its components have been defined at the time of this writing, and despite what you may have heard, Plug and Play—better know as PnP—defines a concept, rather than a discipline. For instance, there's a PnP standard for the ISA slot, another for the COM ports and still another for SCSI devices! So it's no mystery that a fair percentage of hardware vendors will fail in one way or another on their first attempt at implementing Plug and Play.

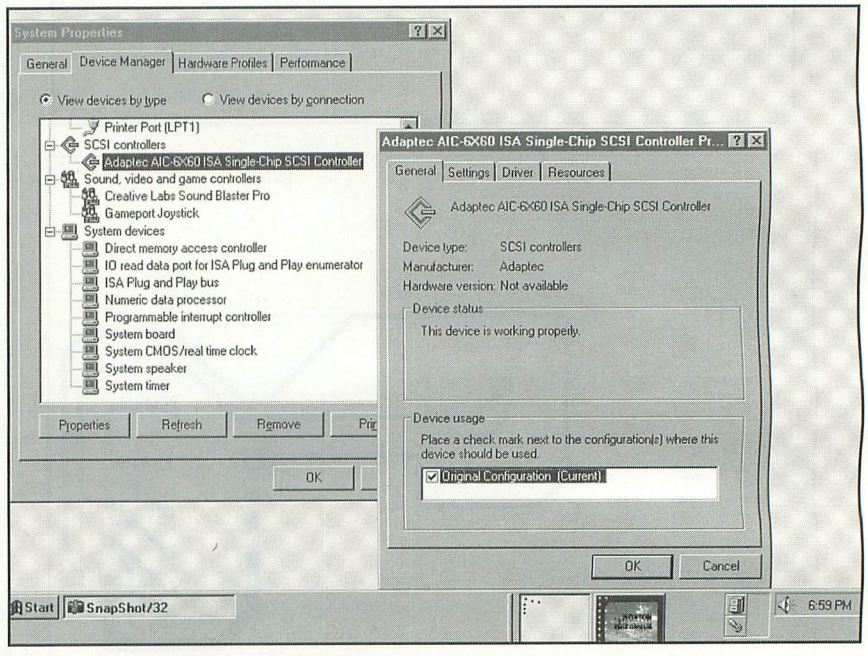


Fig. 1. When installing legacy hardware, it's better to consult the *Windows 95* Hardware Installation Wizard before running the device's SETUP or INSTALL software.

Plug And Play Benefits

A PnP system is one in which you don't have to set jumpers, install software or sort through system (IRQ) interrupts. No matter what peripheral you install, whether it's a modem or a new hard-disk drive, your PC will accept it without question.

This is a benefit for both the vendor and the end user. About 50% of technical-support calls are generated when you add a new hardware device to your system, only to discover it doesn't work. I'm probably the worst offender because I often refuse to read the installation manual, especially those that are poorly written or too condescending to be of any help. Not only does this waste my time and the vendor's money, which pushes up the selling price of the product, it's a real annoyance over something that should be terribly simple. When it works, Plug and Play eliminates this unnecessary nuisance.

Hot-docking, where you can install and remove peripherals while the system is running, also falls under the guise of Plug and Play. However, only PCMIA (Personal Computer Memory Card International Association) devices currently meet this demand. Personally, I can't see the advantage of unplugging my video card from an ISA (Industry Standard Architecture) slot and replacing it with another while the PC is running. On the other hand, adding or removing a

SCSI (Small Computer System Interface) device without re-booting is definitely something I like a lot.

How It Works

The first time I saw plug-and-play hardware for the PC was in an IBM PS/2 system about 10 years ago. Unfortunately, IBM put a lock on the technology (actually, it was an exorbitant license fee for the proprietary MCA bus), so it wasn't universally embraced. Then there was EISA (Enhanced ISA), which came out about the same time as a less-expensive-plug-and play solution. But it, too, died for lack of vendor support. The two were radical bus architectures that tried to corner a market that didn't exist because the CPUs of the time weren't up to the challenge. Talk about selling a cart without a horse and then overcharging for the cart!

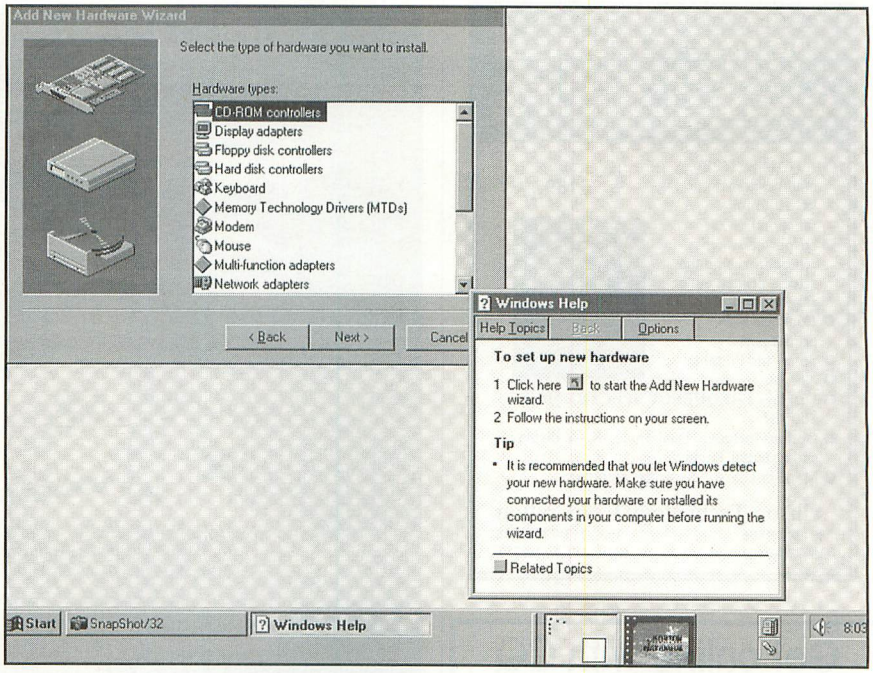
It wasn't until the Pentium CPU and *Windows 95* came along that plug and play became a reality for the average Joe. Plug and Play (notice the caps in the name; it's now a Microsoft trademark, as is PnP) is a combination of hardware and software components that work together as a team. The team consists of three players: the motherboard BIOS, a cooperative PnP hardware device and the operating system (specifically, *Windows 95*).

In an ideal PnP system, the Plug and Play process begins at boot-up, when the BIOS queries the expansion slots and I/O ports to take inventory of attached devices. Each device tells the BIOS where it's located and its function. This information is then conveyed to *Windows 95*, which is now checking the BIOS to see if anything has changed since the last time you booted.

Not all three players have to be present for PnP to work. There are several levels of PnP support, each with its own benefits and limitations. The level of support you obtain depends on how many of these three pieces you have in place.

Legacy Cards

Because most of us will probably upgrade from *Windows* 3.1 to *Windows 95* on a 486 system without PnP support (Pentiums aren't cheap), you need to acquaint yourself with a term called "legacy." In PnP parlance, legacy is generally any hardware device made before August 1995 (the release of *Windows 95*). Basically, it means you bought the hardware more than six months ago, which means it doesn't have the PnP logic needed to communicate with the motherboard BIOS. So chances are good your system is stuffed with a legacy BIOS, a legacy hard drive and a legacy modem. Let's see what occurs when you upgrade to *Windows 95* using this configuration.



The Registry is a *Windows 95* utility that lists the devices in your system and their status. It also has the ability to enable and disable any PnP device right from a screen.

Windows 95 recognizes that supporting non-PnP devices is essential. Unfortunately, neither a PnP BIOS nor *Windows 95* can re-configure legacy devices. Thus, legacy device settings must be accomplished by hand. You still have to set DIP switches or move jumpers to avoid conflicts. What you do gain, though, is a long list of new software drivers for older devices supplied by the Hardware Installation Wizard (Fig. 1).

Hardware Installation Wizard

While everything I've read about installing a legacy device states that it should be only slightly more complicated than installing a PnP device, don't you believe it. The procedure can get really hairy.

If the legacy device isn't installed already don't—I repeat *don't*— run the device's INSTALL or SETUP program. Instead, start the Hardware Installation Wizard, a utility in the *Windows 95* Control Panel, before you plug in the legacy device. Ignore this, and you could spend the rest of your life in computer hell.

Let's take an example. I have an old Video 7 VRAM II video card I use for my back-up system when the hard disk fails on my main PC (yes, my

PCI Challenges Plug and Play

Are you wondering why Plug and Play doesn't work for your PCI board? It's because there's no PnP specification for PCI cards. Theoretically, PCI was designed from the ground up to be plug-and-play-compliant. Many vendors state that their PCI cards are PnP-compatible by definition. But there are many ambiguities in the PCI specification, and I believe it was Murphy (of "Murphy's Law" fame) who wrote the specification.

So what can you do when your PCI device doesn't get along with *Windows 95*? Presently, the only solution is to return it and try with another vendor—and make sure you let the first vendor know why you're returning the product. It's the only way this mess is going to get cleared up.

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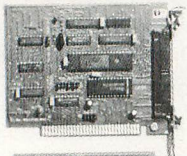
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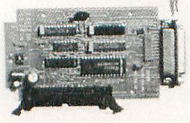
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Why would you want a Plug and Play video monitor? What does it do that any old monitor can't? If it's the ViewSonic 17EA, you get built-in sound with a Energy Star power savings.

hard drive crashes every couple of years, which I suspect coincides with the vendor's need to sell me something new). If you've never heard of Video 7, don't feel embarrassed. This company has been out of business for many years.

As a test, I plugged this 10-year-old video card into my *Windows 95* system to see what would happen. To my surprise, the Wizard recognized it immediately. So I took a closer look and discovered that when you have a legacy card, *Windows 95* looks for an ASIC (Application-Specific Integrated Circuit) chip, rather than a specific card. For example, when I installed a Diamond Stealth 64 PCI card, which is only months old, the Wizard properly identified it as an S3-based video card and installed a generic S3 software driver.

Unfortunately, generic drivers may not be the best software for your card because they don't support some board-specific functions. For example, the S3 driver missed a lot of features the Diamond Stealth 64 has to offer. On the other hand, this is a problematic video card that doesn't work with other cards in more than one of my systems running under *Windows* 3.1. So *Window 95*'s generic S3 driver decision is an excellent choice. At least it doesn't crash *Windows 95*. Diamond states that *Windows 95* drivers for all its cards will be available by the time you read this, and the list of hardware vendors making the same promise grows by the day.

If *Windows 95* doesn't recognize your legacy device, it serves up a long list of hardware options from which to choose. What you do is ripple through the list and find the product that most closely resembles yours, then read the statement that appears on the screen of your video monitor. Generally, you're advised to change settings on the card so that it will work properly in your system. Good advice, but not newsworthy or helpful enough to take up a full screen.

Mix and Match

For some of us, PnP will be a mixture of hardware in which you have a couple PnP devices and a pot load of non-PnP stuff. At this level, *Windows 95* tries its best to avoid hardware conflicts, using the resource arbitrator.

Here's where things can get really tricky.

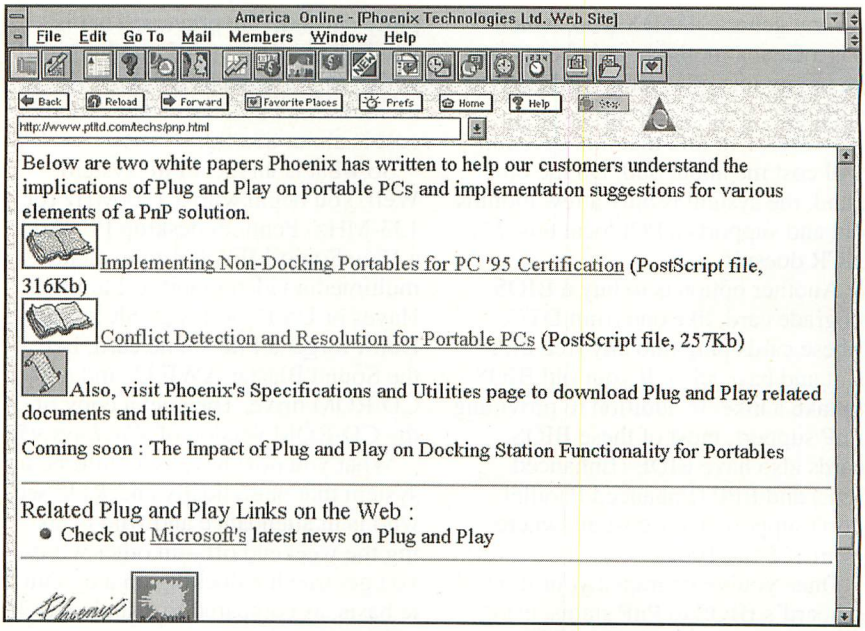
If your motherboard doesn't have a PnP BIOS, *Windows 95* must configure the PnP devices *after* it's up and running. Consequently, the boot drive *can't* be a PnP device. Other victims of this non-PnP BIOS configuration include any device that must be started before *Windows 95*, like the video card and floppy-disk drives—all of which must be legacy devices. Can you install a PnP video card into such a system and have it work? Probably, but I call doing this plug and pray.

Plug and Play BIOS Upgrades

If I had to choose one PnP device to install in my *Windows 95* system, it would be a BIOS upgrade. Fortunately, I have three options—none of which is outlandishly expensive. The option I choose depends on the system I decide to make my permanent *Windows 95* satellite.

The least-expensive option would be to upgrade my NCR 486DX2-66, which has a flash BIOS. For the cost of a telephone call, I can download a PnP BIOS program that I run from the DOS prompt, and *presto!*—my old BIOS instructions are replaced with up-to-the-minute PnP code. Unfortunately, the system is more than three years old and isn't a prime candidate for this upgrade.

Next, I could buy a new BIOS chip



Looking for answers to your Plug and Play questions? Phoenix Technologies has solutions. simply access the WEB at http://www.ptltd.com/techs/ pnp.html, andyou'll find information about mobile PnP, as well as desktops. Moreover, you get links to other sites, like Microsoft's PNP Home Page.

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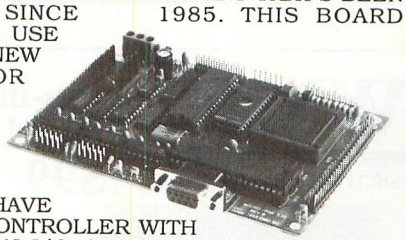
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for my generic 486DX2-66, which has a Genoa motherboard, from Genoa or any one of several third-party suppliers, like Unicore Software. However, I'm told that this decision will cost me about $80. On the other hand, the system is only a few months old and supports a PCI local bus. My NCR doesn't.

Another option is to buy a BIOS upgrade card, like one from DTC. These cards plug into any free ISA slot and basically tell your old BIOS to take a hike. In addition to providing PnP support, most of these BIOS cards also have EIDE (Enhanced IDE) and EPP (Enhanced Parallel Port) support. They cost anywhere from $25 to $100.

Once you've upgraded your motherboard's BIOS to PnP status, using any of the options mentioned above, you take a giant leap from pay and pray to Plug and Play.

What would be my choice of the options I've mentioned? My choice would probably be to save up my money and buy a Pentium motherboard. If I go this route, I'll remove one of the 486 motherboards from its cozy system-unit enclosure and toss it into the closet, where it will wilt away, along with all my other "emergency" spare parts I've amassed as I methodically replace my legacy cards with PnP devices.

Pay the Price

The ideal PnP solution is to pay the piper and skip the prayers. That is, you buy the perfect PnP motherboard with a PnP graphics card, PnP video monitor and PnP disk drives. Total cost is about $3,000.

So what *is* an ideal PnP system? Well, you begin with a 120-MHz (or 133-MHz) Pentium desktop PC. Add a ViewSonic 17EA (or equivalent) multimedia video monitor. Plug in a Hayes or US Robotics 28.8K modem. Don't forget a PnP sound card, like the Sound Blaster AWE32, and a 6X CD-ROM drive. Then get a copy of the CD-ROM version of *Windows 95*.

What you now have is a multimedia system that periodically checks to see who is in attendance and who is taking the weekend off—in other words, you get true hot docking on a dynamic basis, as compared to a static check at boot-up.

Time to Plug In?

When should you take the Plug and Play plunge? Well, you don't have to install *Windows 95* before you can begin the PnP building process. All you need is a PnP BIOS to get started. After this, you can add PnP components at a rate that fits your hardware and budget schedules.

As an example, if your hard drive is more than two years old, it's time to buy a 1.6G PnP drive. Do you plan on jumping aboard the Microsoft Network express? If so, you'll want a PnP modem. As your multimedia needs grow, you'll want a new video monitor, video card and mouse. You can add all these items one at a time, and spread the cost over a period of time. Now what you have to pray for is that Microsoft won't change the PnP standard halfway through your upgrade. ■

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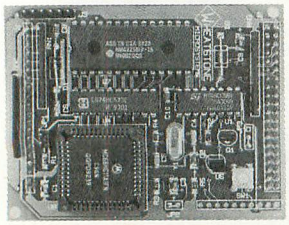
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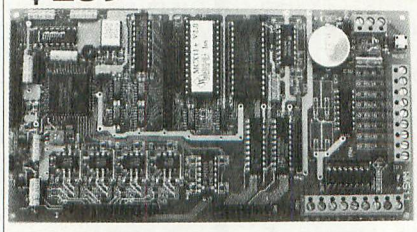
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Development Software for the MMT-188EB Microprocessor Board

Microcomputer theory, 80811 architecture and Paradigm software tools

Last time, I introduced you to the robust and easy-to-use Midwest Micro-Tek MMT-188EB Microprocessor Board and demonstrated how to make it function via the MMT-EBMON monitor/debugger program without having to write a single line of code. This time out, I take you to the next level of MMT-188EB sophistication with a look at some complimentary Paradigm software development products that are especially formulated for the MMT-188EB. Items I cover here include the Paradigm DEBUG/RT-186, LOCATE and PDREMOTE applications.

Since it's necessary that you understand the hardware architecture before you can write software to successfully employ it, I begin by taking you on an in-depth tour of the Intel 80188 microprocessor used in the MMT-188-EB board.

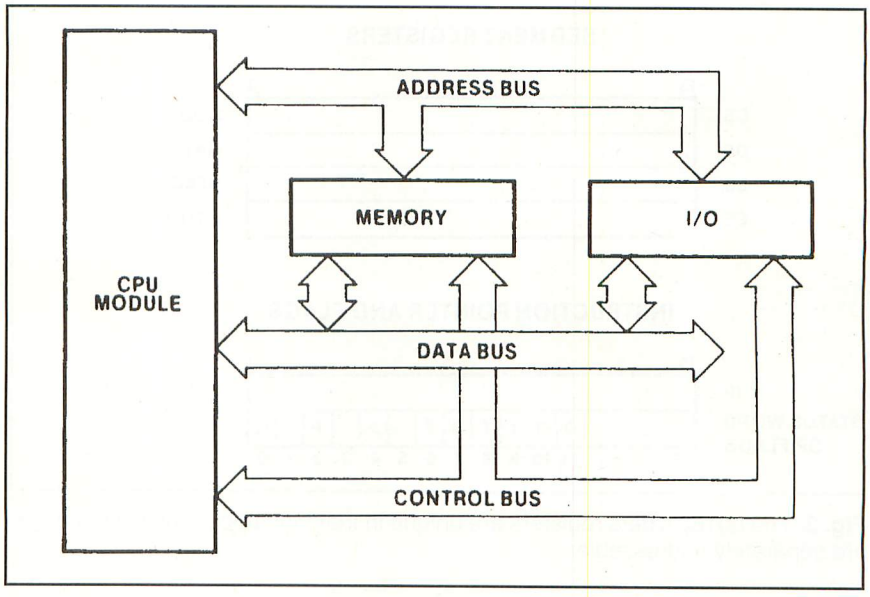


Fig. 1. Block diagram of the elements found in all microcontrollers.

Microcomputer Theory

I know that most of you who regularly read *MicroComputer Journal* know what a microcomputer is and how it's structured, both logically and physically. On a daily basis, I talk to lots of you who are just beginning to get into micros, and it wouldn't be fair to assume that everyone reading this tutorial is "microprocessor literate." As a matter of fact, some of you are probably wondering what a microcomputer versus a microcontroller is, as opposed to, say, a PC.

In contrast to stand-alone microcontrollers and microprocessors, which are normally dedicated devices devoted to a particular logical function, microcomputers are systems that may contain more than one integrated-circuit device that uses semiconductor technology and digital logic to implement large-computer functions on a much-smaller scale—in our case, the Intel 80188 microprocessor and its associated parallel and serial I/O (input/output) ICs and optional LAN (Local Area Network) ICs that make up the MMT-188EB Microcomputer System.

Your computer system most likely contains the three common and necessary elements to every computer system: a CPU (Central Processing Unit), memory and I/O devices or ports. Follow along with Fig. 1 as I give you a closer look at each of these components.

• ***CPU.*** The Central Processing Unit is the heart of any microcomputer system. Normally, it's responsible for the arithmetic and logical operations, as well as for providing timing for the rest of the system components. The CPU's resulting operations are guided by something known as a program.

Programs are written by people like you and me in a multitude of programming languages and are stored in memory, usually as a binary image that logically represents the human form with which we created them. This human form is called source code.

Source code is simply words we understand and give to an application called an assembler or compiler that, in turn, translates our human language

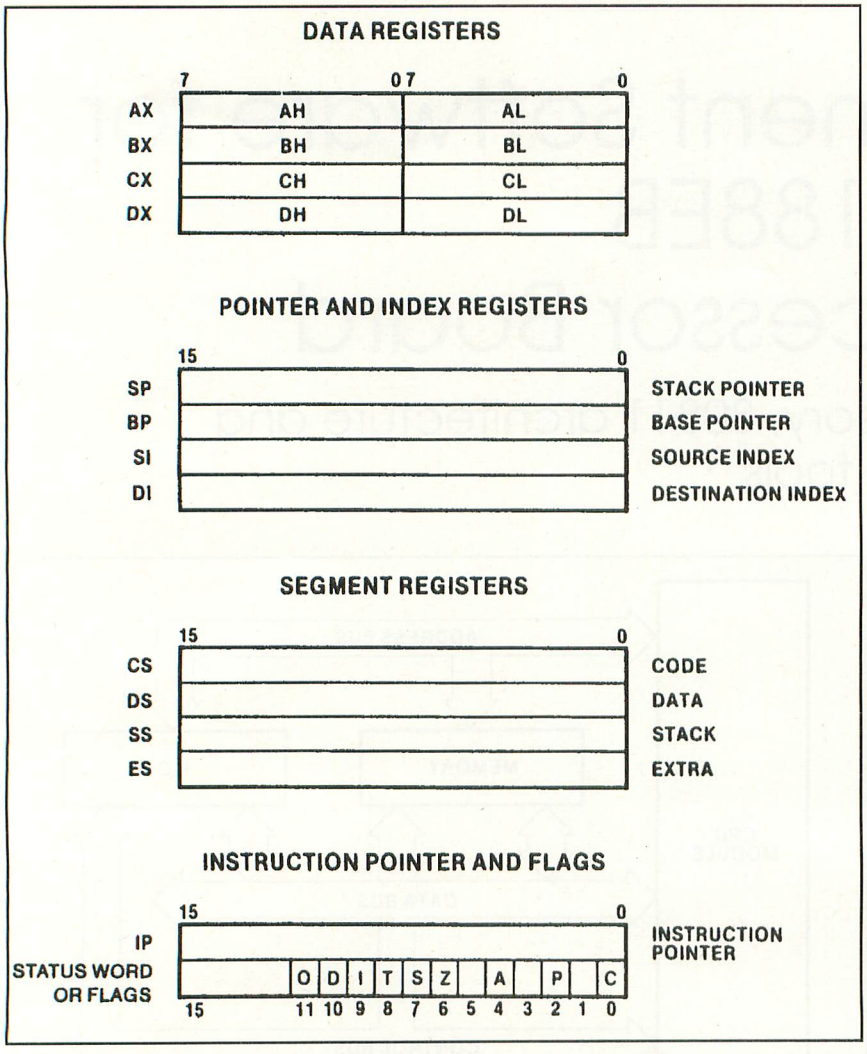


Fig. 2. The 80188's data registers are unique in that their upper and lower halves are separately addressable.

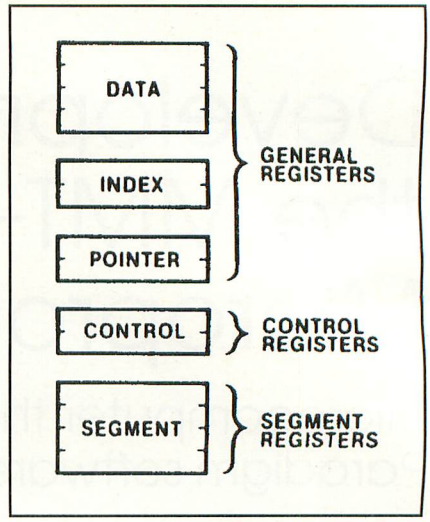


Fig. 3. Registers in the 80188 are divided into three distinct groups.

to binary representation that the silicon inside the CPU can understand. You could say a program is a logical sequence of instructions that perform a predetermined task.

The CPU is responsible for reading data and instructions through its input ports, executing the fetched instruction as it relates to any pertinent data contained within its internal registers or memory and responding to the outside world by sending resultant data and control signals through its output ports.

There are typically three functional units within a CPU: the registers, the ALU(Arithmetic/Logic Unit) and the control circuitry.

Registers provide temporary storage within the CPU for addresses, status codes and any other information the program (and human programmer) needs to store or manipulate. The 14 registers in the 80188 are 16 bits wide.

Almost all CPUs have some sort of ALU. Without an ALU, the CPU wouldn't be able to perform even the simplest of arithmetic operations. Addition and subtraction are the most-common basic operations the ALU performs. Some more-advanced CPUs have ALUs that have the capability of doing multiplication and division as well. The ALU also contains flag bits that indicate the results of arithmetic and logical operations. These flags include the zero, carry and sign flags.

Control circuitry inside the CPU is responsible for coordinating all microprocessor activity. A clock source connected to the CPU clock inputs, usually a crystal or crystal oscillator, maintains the proper sequence of events that are required for any processing task the system is called upon to perform.

• ***Memory.*** Microcomputers today tend to use semiconductor memory, such as static or dynamic RAM and EPROM or EEPROM (Electrically Erasable Programmable Read-Only Memory) to store programs and associated data. RAM (Random-Access Memory) is commonly used for volatile storage, while EEPROM or EPROM (Erasable Programmable Read-Only Memory) is normally used to store the binary program image. The MMT-188EB permits the program image to be stored in RAM as well as EPROM. This lets us as programmers instantly load a binary program image into the MMT-188EB's RAM disguised as EPROM and execute it without having to burn an actual EPROM.

• ***Input/Output Devices.*** I/O devices are the means by which a CPU and its associated components can intelligently communicate with the outside world. You can relate this concept to something you know well—your PC. The PC's keyboard is connected to an input port while the PC's video display is interfaced to an output port. In the case of the MMT-188EB, the 8255 Parallel I/O and the Maxim RS-232 chips provide both serial and parallel I/O capability.

There are various other I/O components that are actually smart and relieve the CPU of some of the I/O processing burden. You normally find these I/O devices in more-complex

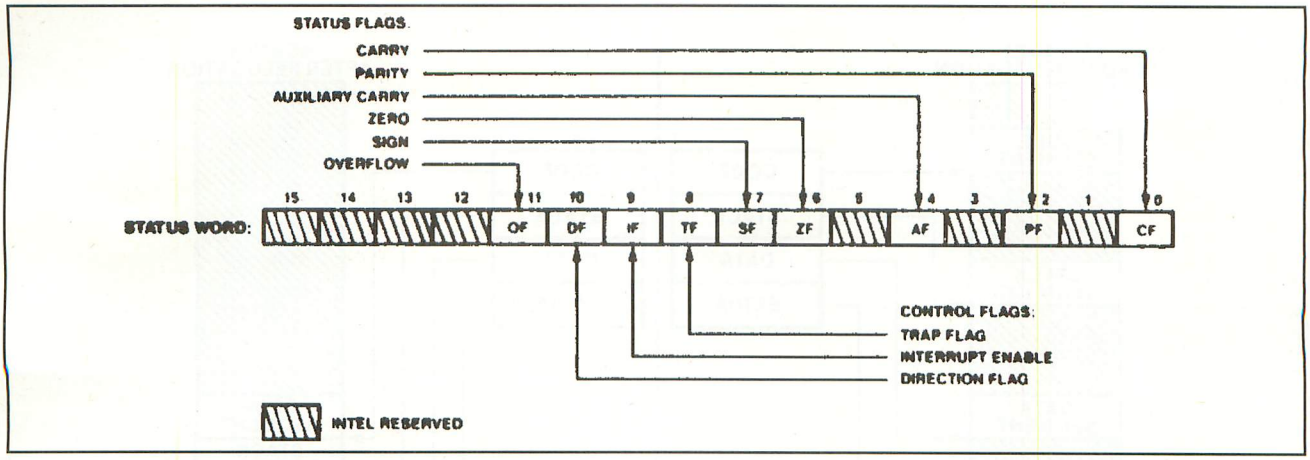


Fig. 4. This is a detail of the 80188's flag bits.

microcomputer systems, such as your desktop PC.

A good example of a smart I/O component is the UART in your PC's serial subsystem. The UART is responsible for sending and receiving serial data and control signals via the serial port, with little assistance from the CPU. (Though it's beyond the scope of this discussion, the compact MMT-188EB contains some of these CPU time-saving ICs, too!)

• ***Buses.*** The CPU, memory and I/O devices can be and usually are separate entities. For a microcomputer to be something other than a collection of unrelated electronic parts, each of the three subsystems must have a means of communicating with the others. This conduit of communication is called a bus. In the case of the 80188 and MMT-188EB, three buses meld the CPU, memory and I/O into a cohesive microprocessing unit. These are the data bus, the address bus and the control bus. Simply stated, a bus is a parallel collection of conductors that provides a means for components or subsystems to exchange address, data and control information.

Data Bus. The data bus is the means by which binary data travels between the CPU, memory and I/O. This data can be instructions for the CPU or I/O data destined for the UART in a serial port. The data bus provided for the 80188 in the MMT-188EB microcomputer is eight bits wide.

Address Bus. Under program control, memory and I/O devices are selected by the CPU, using the address bus. Each device on this bus must have a unique address to be selected. Otherwise, I/O and memory chaos would occur, normally referred to as "contention." Contention is the state in which more than one device is attempting to simultaneously use a bus for output purposes. The address bus is normally tied directly to the EPROM and RAM address buses, and semiconductor logic decoders like the 74LS138 use some of the address lines to select particular memory or I/O devices.

Control Bus. Control signals carried across the control bus determine if an

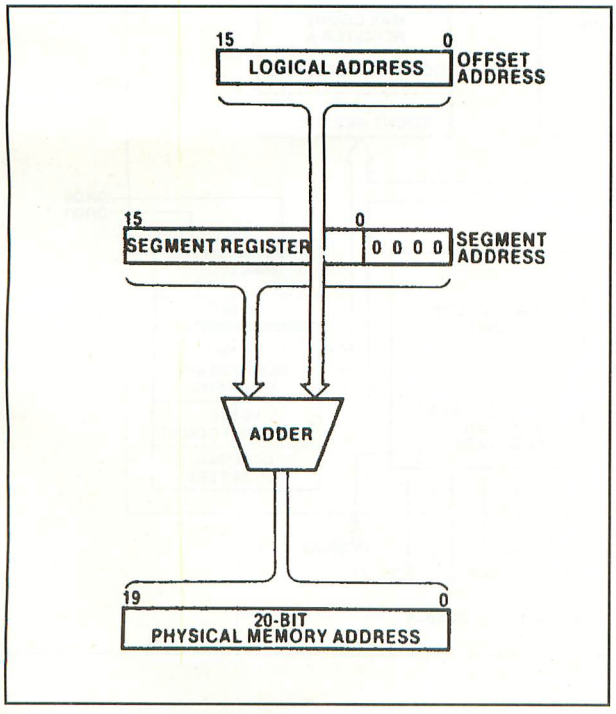
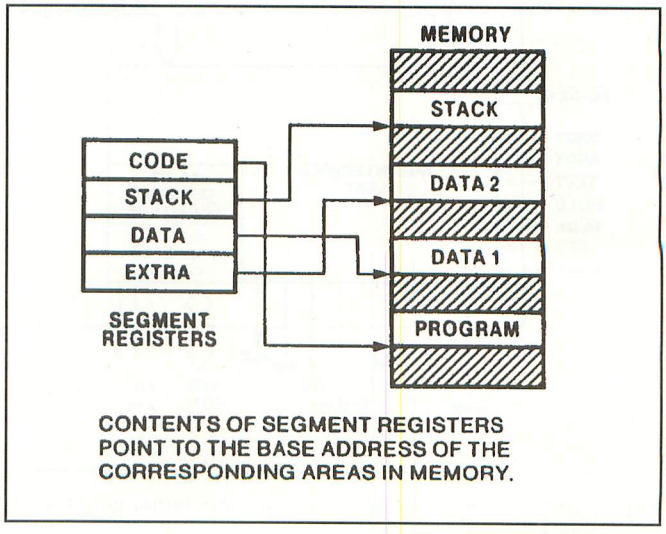


Fig. 5. Address calculation for the 80188.

Fig. 6. Each of the 80188's four segment registers points to the beginning of a 64K area in real memory.



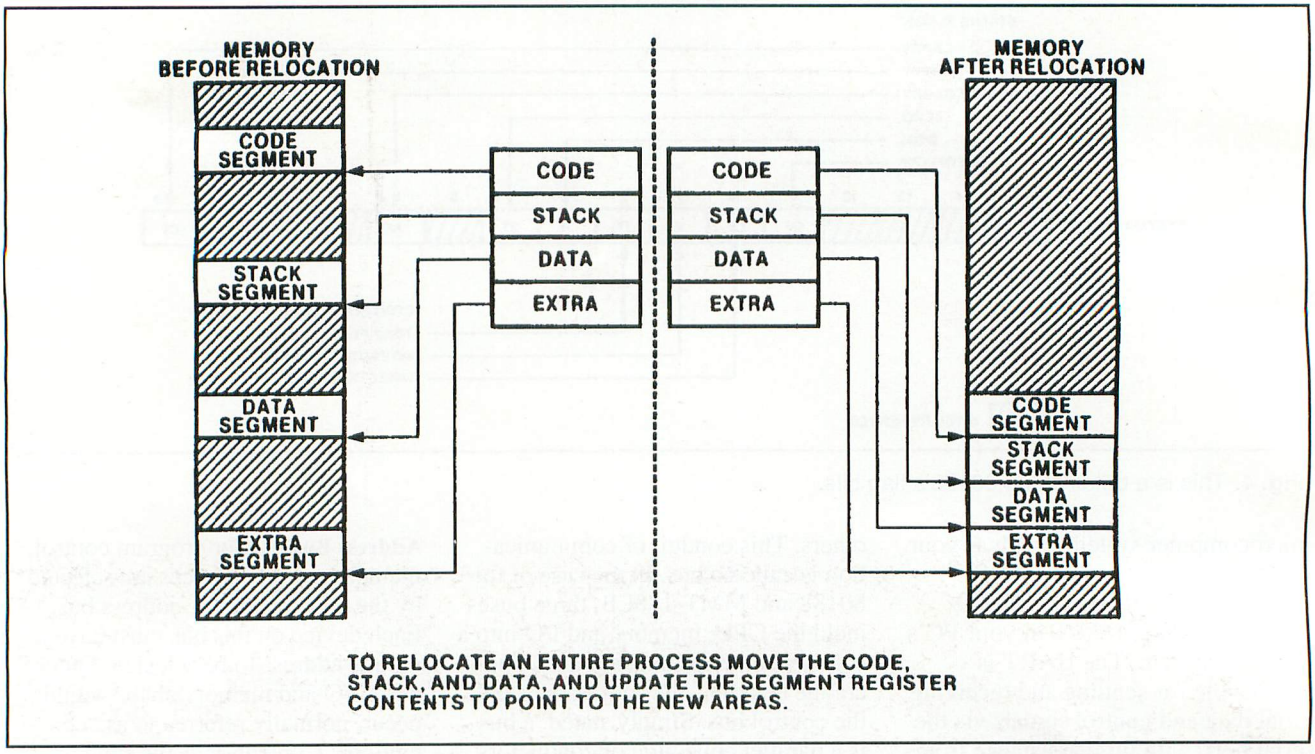


Fig. 7. How an application can easily be relocated by moving the code and updating the segment registers.

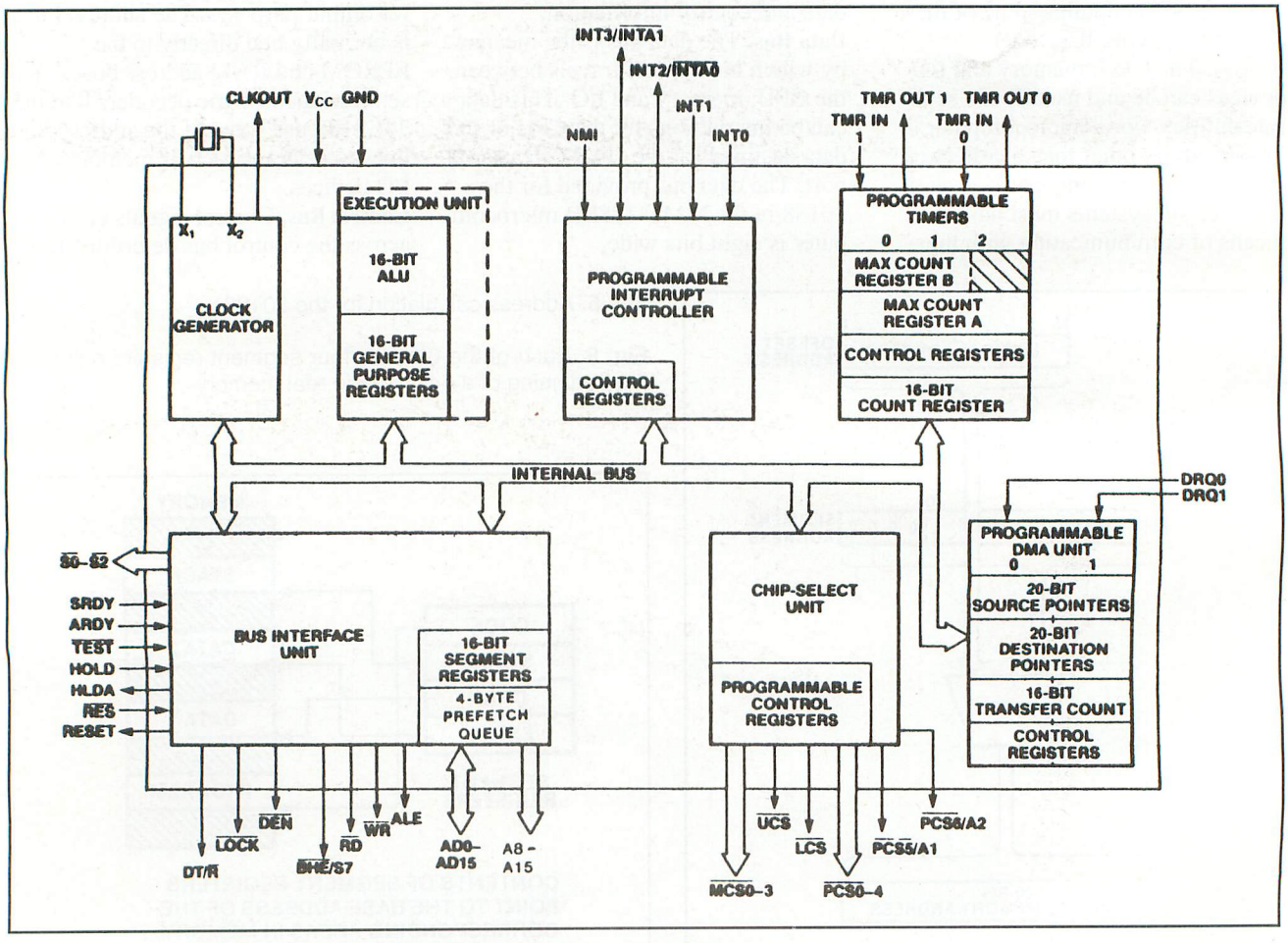


Fig. 8. This is a logical view of the internal elements of the 80188

operation is input or output, read or write. Control signals also help in determining exactly when data should be transferred. Some common control signals are RD (read), WR (write) and ALE (address-latch enable).

80188 Architecture

The 80188 is a descendant of the Intel 8086 family of microprocessors. Four key architectural concepts differentiate the 808X and 80188 from other microprocessors. These are memory segmentation, operand addressing structure, operation register set and instruction encoding.

The 80188 memory-segmentation scheme is optimized for the programmer. High-level programming languages benefit directly from the 80188 addressing structure and instruction encoding, while the 80188 register set supports general-purpose computing requirements and some really handy special functions.

Referring to Fig. 2, note that the 80188 data registers are unique in that their upper and lower halves are separately addressable. Each data register can be either a single 16-bit register or two eight-bit registers. H and L following the A, B, C and D denote high and low bytes, respectively. X signifies that the register is 16 bits wide. For example, AX is 16 bits wide, while AL is eight bits wide on the low byte of AX, and AH is eight bits wide on the high byte of data register AX.

Figure 3 illustrates that the 80188 registers are divided into three distinct groups. The general register group consists of the standard data registers and index and pointer registers. The index registers provide a means for manipulating strings and data structures, while the pointer registers provide a means of passing parameters within the stack. The index and pointer registers can also be used as general-purpose registers when their special functions aren't required.

The control registers are made up of the IP, or Instruction Pointer, and Status Word that contains the flag bits. A detail of the flag bits, or Status Word, can be seen in Fig. 4. There's nothing different or magical about the flags. They're not unlike any other microprocessor's flag bits in meaning or usage.

Finally, there are the four segment registers. These are the basis for the formulation of memory addresses. The 80188 uses a 20-bit physical address that's calculated by shifting left the base value in the appropriate segment register by four bits and adding the 16-bit offset value to it. (As for the address calculation, Fig. 5 is better than words.)

Every 20-bit memory address points to an area in memory, whether it's program code, stack or data. As Figure 6 reveals, each of the four segment registers points to the beginning of a 64K area in real memory. The code-segment register points to the base of the program code, the data-segment register to the beginning of the data area, the stack-segment register to the base of the stack and the extra-segment register usually to an additional data area.

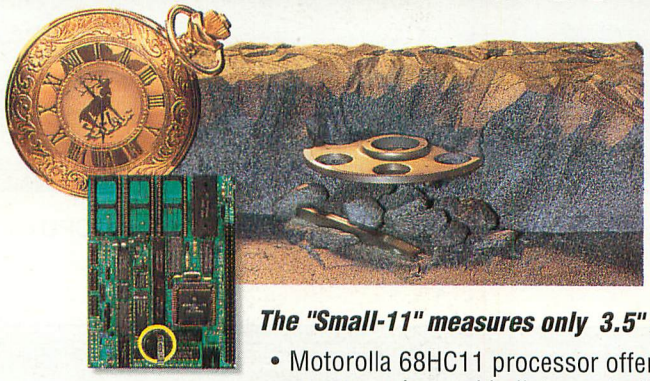
Since all 80188 branch and jump instructions are relative (not assigned or computed to use a particular memory address), segmentation permits a program and its associated data areas to be dynamically located anywhere within a 1M-byte range. A graphical example of how an application can easily be relocated by simply moving the code and updating the segment registers is shown in Fig. 7.

In summary, the 80188, which contains an enhanced 8088-2 CPU, also integrates a chip-select logic unit, two independent high-speed DMA (Direct Memory Access) channels, three programmable timers, a programmable interrupt controller and a clock generator. In effect, if you can write programs for the 8086 or 8088, you can write code for the 80188. The real advantage is that the code you write can be written in C, Pascal or assembler, to name just a few programming languages. Figure 8 gives a logical view of the 80188 internals.

Paradigm Software

Paradigm DEBUG/RT-186, in conjunction with Paradigm PDREMOTE and Paradigm LOCATE, is a comprehensive and powerful development package. DEBUG/RT-186 permits program tracing, back-tracing, stepping, viewing, inspecting, changing and watch-

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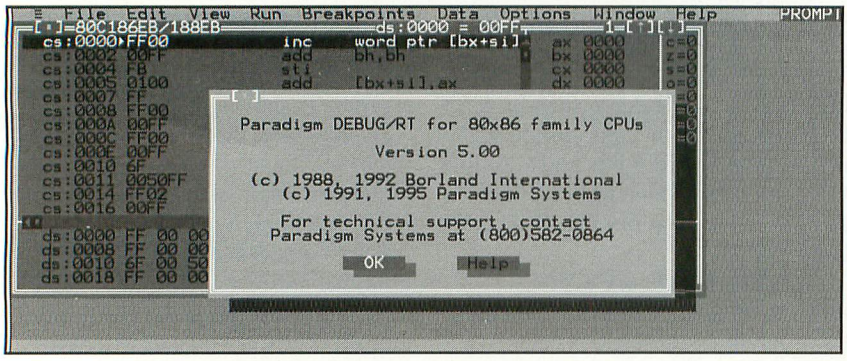


Fig. 9. This is the initial DEBUG/RT-188 screen.

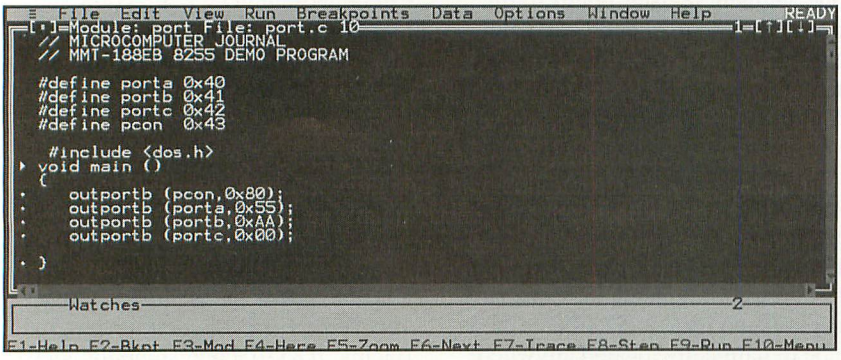


Fig. 10. Shown here is an example of C source form loaded into the DEBUG/ RT-188 application.

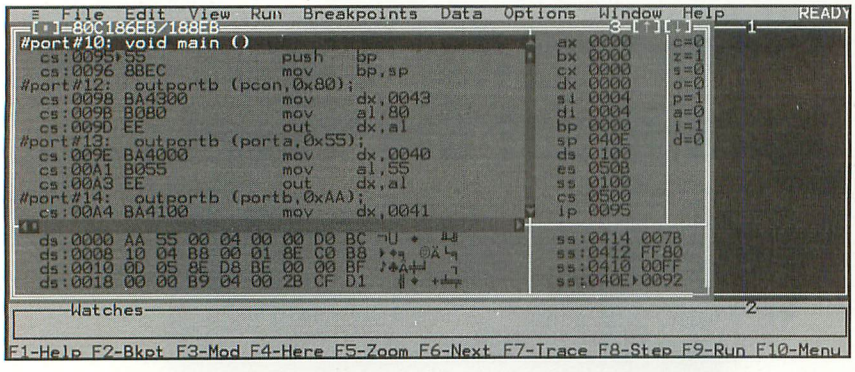


Fig. 11. This screen appears when you select View and choose the CPU option.

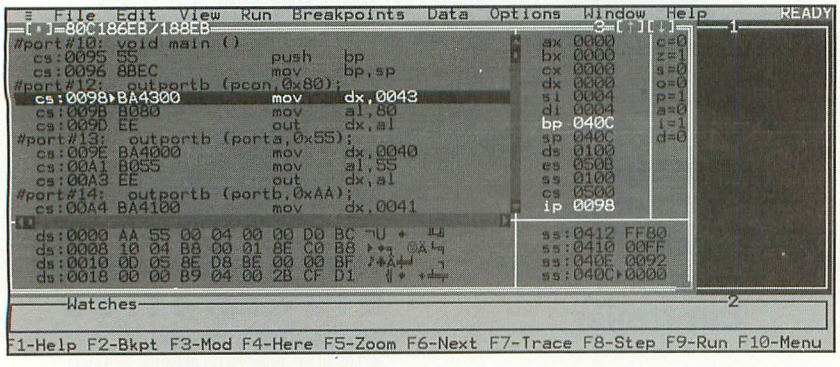


Fig. 12. This is the result of single-stepping to the MOV DX, 0043 instruction.

ing—all from a very well-laid-out operator's panel. Figure 9 is a capture of the initial DEBUG/RT-186 screen.

PDREMOTE is a communications package that lets you build an interface to the target processor. I like the way the instruction manual puts it: "PDREMOTE is the eyes and ears of Paradigm DEBUG/RT-186." This application permits the MMT-188EB to be connected to a PC via the serial port for in-circuit debugging using DEBUG/RT-186.

LOCATE is an application that's designed to prepare code written in Borland and Microsoft C to be placed in the MMT-188EB's RAM memory or burned into an EPROM. LOCATE uses various compiled components and configuration files to place your code in the proper memory locations.

The Paradigm products come with comprehensive documentation and a wealth of helpful example code. In fact, I could write a number of articles based solely on the power and flexibility of these applications! Instead, I'll show you some screens that demonstrate just how powerful and easy to use the Paradigm DEBUG/RT-186 system can be.

I don't assume everyone writes or understands C. So, my demo C application is purposely very small and very simple. Paradigm and Midwest Micro-Tek provide pre-written start-up code that initializes subsystems on the MMT-188EB. Assume this code has already been run for our example. The demo program is a simple write-to-port (8255) application.

Shown in Fig. 10 is my example in C source form loaded into the DEBUG/RT-186 application. This was accomplished by the Open command under the File menu item. Note that I could actually step through the C code here if I wished to do so.

By selecting the VIEW menu item and taking the CPU option, Fig. 11 appears. Notice that the C source is still present in the code window, with the addition of the actual assembler code generated from the C statements. This should really turn on some lights, sound some buzzers and ring some bells! You already have a full view of the application without having to do anything complicated.

The section directly below the code window is the dump area. Note that the dump area is referencing DS, or

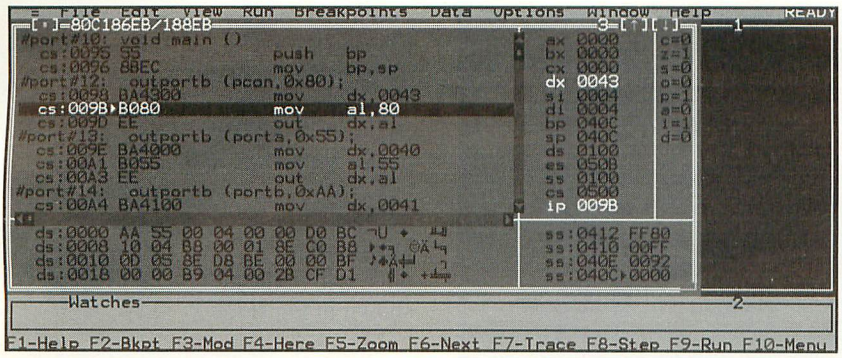


Fig. 13. This is the result of executing MOV DX, 0043.

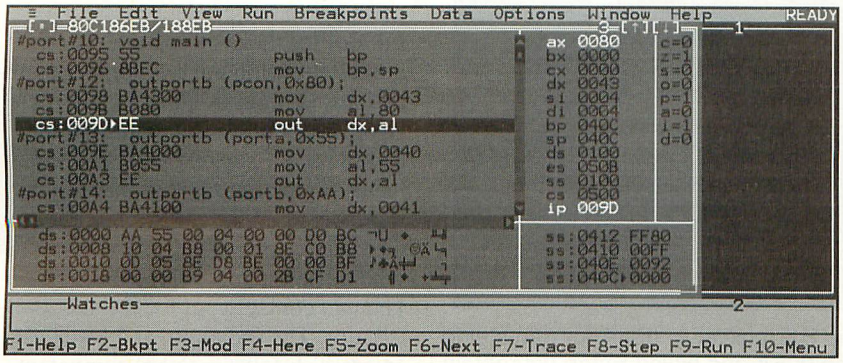


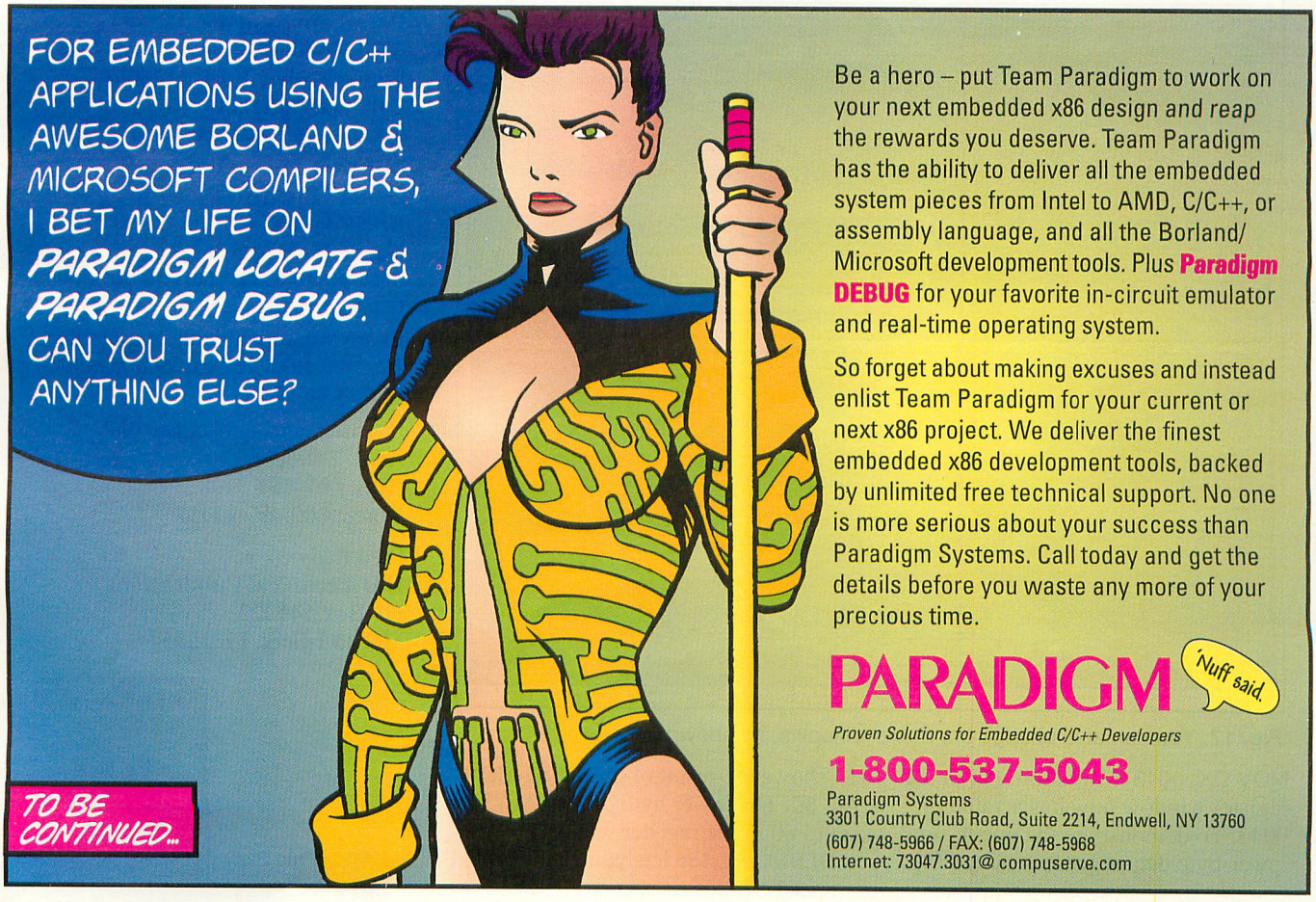
Fig. 14. This is the result of executing MOV AL, 80.

the data segment. To the immediate right of the dump area is the stack display. In the register area above the stack display, the stack pointer (sp) is set to the same address as the pointer in the stack-display area.

Using LOCATE, I placed the beginning of my code in the MMT-188EB RAM at offset 0500. You can see this by examining the CS register in the register area, which reads 0500. So, the absolute address of the beginning of my code would be 0500:0000.

I also instructed LOCATE to place the DS beginning address at 0100:0000. This, too, can be seen in the register window. The flags are shown directly to the right of the register display. You may be wondering why I'm sitting at the beginning of the program and the IP (instruction pointer) isn't at 0000. Remember that I executed some start-up code before I got here.

Figure 12 is the result of single-stepping to the instruction MOV DX, 0043. The instructions I executed changed the bp register and the stack. With another single step, Fig. 13 displays the results of executing the



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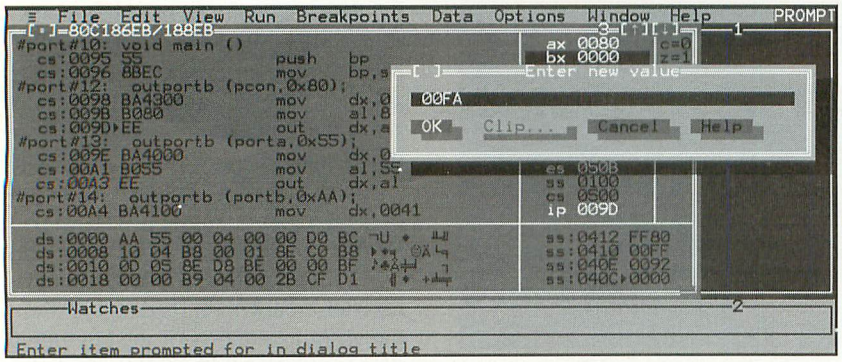


Fig. 15. As you can see, the BX register currently contains a value of 0000.

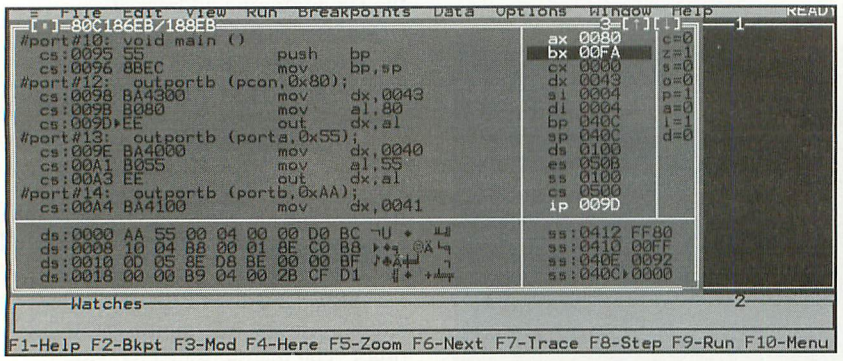


Fig. 16. When you change the value in the BX register to 00FA for debugging purposes by highlighting the register, typing 00FA and hitting Enter, you obtain the results shown here.

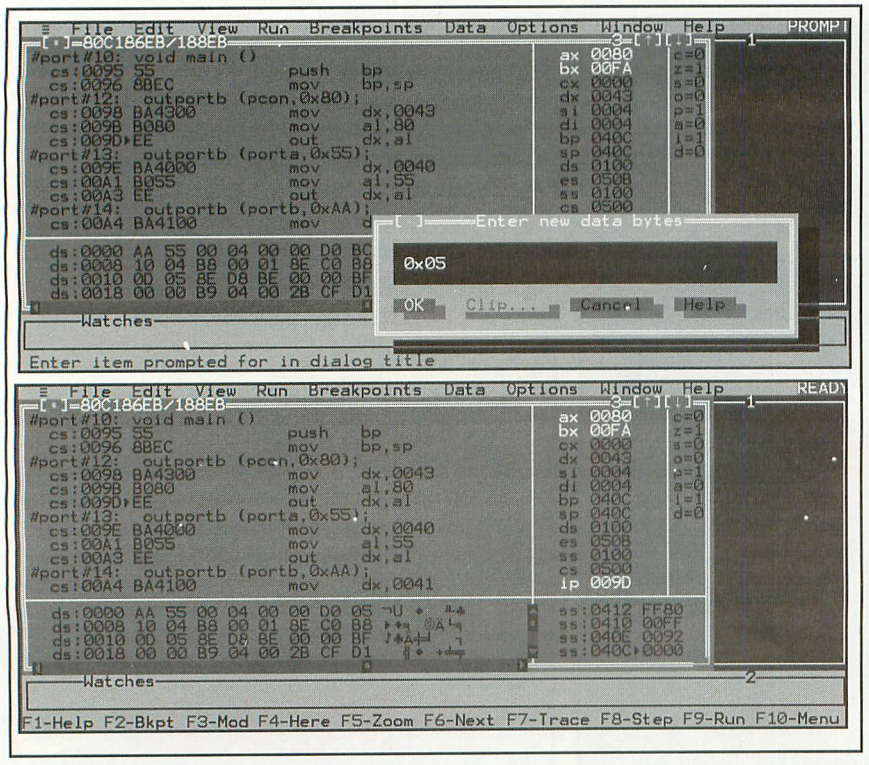


Fig. 17. You can also change the dump windows, as shown here.

MOV DX, 0043 instruction. DX in the register window now has a value of 0043. To demonstrate the upper- and lower-byte data register concept, Fig. 14 shows the result of executing MOV AL, 80. The lower byte of AX (AL) is set to 80 in the register window.

DEBUG/RT-186 lets you change the dump and register values on-the-fly. Figure 15 illustrates that the BX register currently contains a value of 0000. As a programmer, you want this to be changed to 00FA for debugging purposes. To do this, you simply highlight the register, type in 00FA and hit the Enter key to obtain the results given in Fig. 16. The same can be done within the dump window, as shown in Fig. 17.

Summing Up

As you can see from the foregoing, the Paradigm/Midwest-Micro Tek partnership has produced a very useful tool for those of you who need to quickly develop microcomputer applications. Of course, since I couldn't cover every nook and cranny of the 80188 here, I suggest you get your hands on the Intel 80188 manuals for more details. You can purchase these manuals from many of the vendors who advertise in this magazine, or you can contact your local Intel distributor. The Paradigm and Midwest Micro-Tek folks are very competent and friendly as well. You can reach them at:

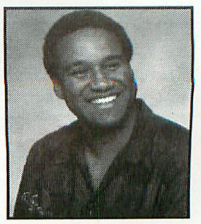
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By Tom Benford

Multimedia To Go

Powerful portable peripherals let you take your multimedia capabilities along with you

I've been an aficionado of portable computers since the eight-bit CPUs that predated the IBM PC, when I lugged around my 26-lb. Commodore SX-64 "portable" to trade shows and on business trips more times than I care to remember. Since then, I've progressed at various steps along the way to a 12-lb. 286-based laptop machine with gas plasma (ugh!) display, to a 386-based "paper-white" LCD-screen notebook, to my current 75-MHz 486DX4 NEC Versa E Ultralight notebook with active-matrix color.

While I've benefited from the increased productivity these portable PCs have made possible for me, I've sorely missed the multimedia appointments of my desktop machine, namely a CD-ROM drive, 16-bit sound and the ability to capture video. I'm delighted to report that, at long last, technology has progressed sufficiently to make all of these capabilities and more an affordable reality. In this article, I discuss some of the add-on options that PCMCIA-equipped notebook owners may want to consider.

Before I proceed, however, it's a good idea to make the case for using a notebook PC as your main machine in the first place.

Well-Tempered Notebook

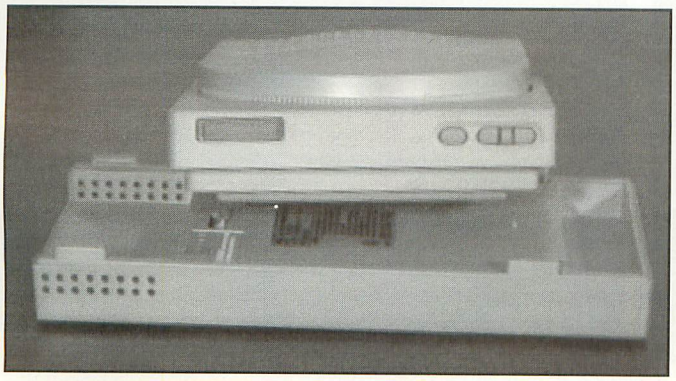
Notebook PCs are the way to go if you want speed, power and the ability to easily take your important files, applications and work along with you. Early laptops were a half-way step between being portable word-processing/database/spreadsheet engines and fully functional desktop PCs.

With the advent of large-scale integration (LSI), high-capacity disk drives, low-current CPUs and PCMCIA technology, came the birth of the high-powered notebook PC. By adding the peripherals you want and as you need them, you can have all of the functionality of a full-fledged desktop or tower PC, but you'll be able to tote this mighty mite along with you inside a carry bag or briefcase without suffering a hernia in the process.

By adding a docking station to your portable setup, you can have the ability to add 16-bit expansion cards, additional drives (floppy, hard and/or CD-ROM) to increase the capabilities of your notebook PC when you use it on the desktop in your office.

Thanks to the new Pentium-based notebooks, many of which feature built-in 16-bit sound and CD-ROM drives, the slightly older 486-based notebooks without these built-in multimedia features can be had for a fraction of their original selling prices. These represent the best bargain, and you don't necessarily have to give up anything along the way.

I highly recommend getting a notebook with a DX4 CPU in it. These DX4 CPUs are informally known as "Pentium lites" because they come very close to a 60-MHz Pentium in speed. My NEC Ultralite Versa E has a 75-MHz DX4 CPU in it, which is more than adequate for even the most-ambitious multimedia tasks I demand of it. If you can spring for the extra bucks, I also recommend getting a notebook that has an active-matrix color display, since this is the brightest and easiest to view for prolonged sessions. Though dual-scan color dis-



NEC's portable 3XP+ CD-ROM drive shown atop its optional rechargeable Ni-Cd battery pack here. The drive is caddie-less and features discrete audio play controls that allow it to do double-duty as a portable audio CD player. (Videograph by Tom Benford)



Rear view of 3XP+ shows its dual SCSI-II connectors that make daisychaining possible, separate power jacks for an ac adapter and optional battery charger, DIP switches for selecting SCSI device ID and digital output jack—a nice high-end touch that further augments this drive's triple-speed performance. (Videograph by Tom Benford)

plays come a bit cheaper and are good, their video speed and brightness are no match for active-matrix technology.

If you shop wisely and scour the mail-order catalogs, you can probably get a 75-MHz DX4 with 8M of RAM and a 540M hard drive for a lot less than $2,000. By adding a docking station for another $400 to $600, you can literally have the best of both the portable and desktop worlds. Alternatively, you can use the money you might spend for a docking station to add some additional goodies to your notebook that will give you all the multimedia functionality you need without sacrificing portability.

With the foregoing in mind, let's take a look at the latest crop of peripherals that greatly enhance the productivity and functionality of the notebook PC.

Portable SCSI

By adding a SCSI interface to your notebook PC, you get a wide range of choices for a CD-ROM drive (or such other external SCSI devices as magneto/optical, DAT and hard drives) you can connect to your computer. You also have the option of using the parallel port or a PCMCIA slot to accommodate your SCSI interface.

Most of today's notebook PCs come with at least one PCMCIA slot, with the vast majority sporting two of these credit-card sized expander bays. While two slots are certainly better than one, power users may find themselves wishing for a third slot, especially if they want to keep a fax/modem and/or a network card installed in their notebook PCs as well. For such users, a parallel-to-SCSI adapter might be a better way to go.

Shuttle Connection Parallel-to-SCSI Interface. The Shuttle Connection enhanced parallel port adapter from Shuttle Technology plugs into the printer port of a laptop, notebook or desktop PC and uses an automated intelligent installation program to examine the machine's parallel port, run some read/write transfer tests to determine and configure itself for fastest possible data-transfer rate.

I've used Shuttle Connection with various 2X, 3X and 4X drives and, depending on type and speed of the host PC's parallel port, found it to deliver excellent multimedia performance. For example, connected to my Versa E using EPP mode, I obtain smooth full-motion video and uninterrupted audio, even from some of the most-demanding CD-ROMs with which I've run it.

Shuttle Connection also has a pass-through connector that permits it to function as a transparent device so that you can connect your printer to it simultaneously.

The Bus Toaster PCMCIA SCSI Interface. The Bus Toaster was one of the first PCMCIA-to-SCSI adapters to appear on the scene. I used it with great success in my Versa for more than a year to connect to it a variety of SCSI devices, including CD-ROM, magneto-optical and hard drives. The device is SCSI-2-compatible and comes with Corel SCSI software and a SCSI-2 cable.

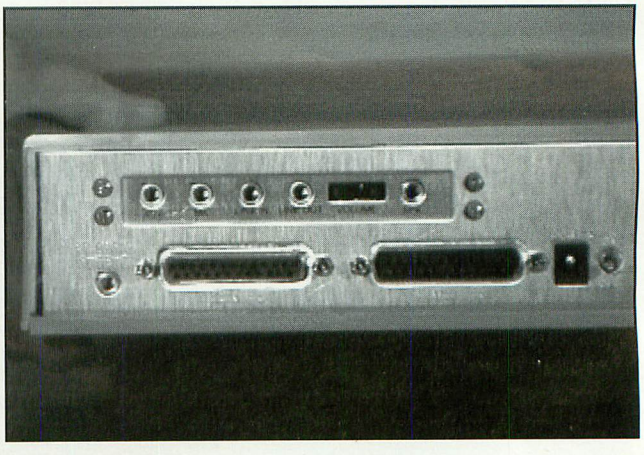
Installation is simple and straightforward, and CardSoft card and socket services software is provided. It's easy to use and very dependable, and it permits "hot-swapping" that lets you pop out the card with your notebook PC turned on if you need to use the PCMCIA slot for another purpose.

NEC PCMCIA SCSI Adapter. NEC Technologies PCMCIA SCSI 16-bit PCMCIA SCSI host adapter occupies a single PCMCIA slot and comes with a 3-ft. cable terminated in a high-density SCSI-2 connector. The cable is flat, rather than round, which makes for easier positioning of peripheral devices. CardSoft card and socket services and Adaptec EZ-SCSI software are provided and, as a bonus, a CD-ROM that contains 11-million business telephone numbers is supplied. The card installs easily and won't pose a problem for even a novice to PCMCIA device installation.

.WAVjammer 16-Bit PCMCIA Sound Adapter. This 16-bit PCMCIA stereo sound card from New Media was the first portable audio device to give me aural capabilities that could go on the road along with my notebook PC. It's a compact rectangular module that connects to the supplied PCMCIA card via a short cable. The module is



Like the 3XP+, the Panasonic KXL-D720 CD-ROM drive features discrete audio player controls so it can double as a portable audio CD player. Drive can be powered by a supplied ac adapter or AA cells, making it incredibly lightweight. (Videograph by Tom Benford)



Rear panel of Backpack 4X CD-ROM drive has multiple I/O ports for sound card located at top, including a thumbwheel volume control. Drive attaches to a PC's printer port and features a pass-through connector for attaching printer to drive. Whole unit weighs only 4 pounds, making it easily portable. (Videograph by Tom Benford)

equipped with three stereo mini-phone jacks, one each for microphone input, line-level input and headphone output.

.WAVjammer comes with Microsoft Sound System software and has all the features and capabilities you'd expect in a high-end 16-bit sound card. These include CD-quality audio, full mixing capabilities, record and playback capabilities, voice navigation, business audio and SoundBlaster and Adlib compatibility. The device weighs only a couple of ounces and easily tucks away in a pocket of my notebook PC's carrying case.

I use lightweight personal-stereo-type headphones for private listening and a less-than-$12 battery-powered monophonic mini-amplifier/speaker that's good for boosting audio volume to levels suitable for group listening when making presentations that don't require stereo. When true stereophonic reproduction is required, I use a pair of Labtec CS-150 speakers (about $29 list) that are powered by two C cells per unit.

Portable SCSI + Audio

As I mentioned earlier, two PCMCIA slots sometimes just aren't enough, and I'm a case in point. With the Bus Toaster SCSI and .WAVjammer sound cards both plugged into my Versa, I couldn't keep my PCMCIA fax/modem installed at all times. That's why I was happy to hear about the next product.

Multimedia Combo Sound/SCSI II PCMCIA Adapter. New Media's Multimedia Combo is the first simultaneous multifunction PCMCIA card to combine a high-speed SCSI adapter with a 16-bit sound card. In effect, it unites The Bus Toaster and .WAVjammer into one elegant design that requires only a single PCMCIA slot. With Multimedia Combo, I now have concurrent SCSI and audio capabilities and can also keep my fax/modem or video-capture card installed and ready for use at all times.

Multimedia Combo works flawlessly and has all of the same features and performance of the two discrete devices it combines. The external connection to the PCMCIA card is a dual cable. One cable terminates in a SCSI-2 connector, while the other has the audio module attached to it. The audio module has been upgraded to include a fourth mini-phone jack, designated as CD input, in addition to the microphone and line-level inputs and headphone output jacks.

Portable CD-ROM Drives

The vast majority of software for multimedia applications is available on CD-ROMs. This is the way to go for efficient and speedy operation in any area of modern computing but most especially in multimedia computing with its frequent large sound and video files. In the CD-ROM-drive arena, you have a wide variety of choices. The following two drives represent good examples of what's available.

NEC 3XP+ (CDR-401) Portable Drive. This SCSI-2 drive has been around for a while now and continues to be one of the most-popular models for people who are looking for a solid performer with which they can travel. By adding a battery pack, the drive is a good companion to use for multimedia on the go. Since it has dedicated player controls, it can double as an audio CD player.

A battery pack adds about 1.75 lb. to the approximate 2.25-lb. weight of the drive, making the combo a rather hefty package to tote around. Supplied are an ac adapter and a SCSI-2 cable. The battery pack/charger is an extra-cost option.

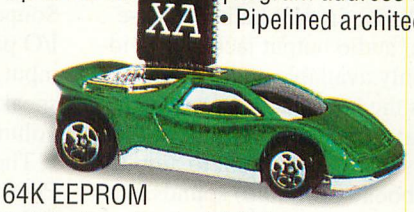
The drive has two separate power jacks on its rear panel, one for using the supplied ac adapter and the other for connecting the charger to rejuvenate the optional battery pack without having to remove it from the drive. Other desirable features are a second SCSI-2 port for daisychaining other SCSI devices and a phono jack for digital output, the latter a high-end feature you wouldn't expect to find on a portable drive. These features, coupled with its 3X speed, make this a most desirable portable drive, albeit a bit on the heavy side.

Panasonic KXL-D720 CD-ROM Drive. This double-speed PCMCIA CD-ROM player comes with its own PCMCIA SCSI-2 card, interface cable and installation software. Like the NEC unit, the KXL-D720 is capable of independently playing music CDs by virtue of its dedicated audio player

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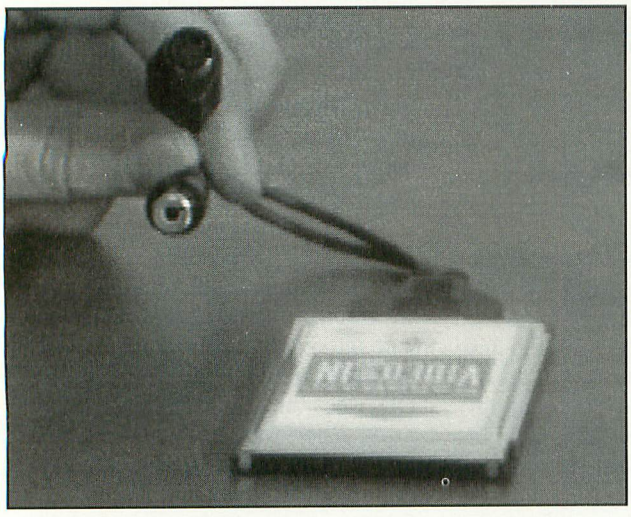
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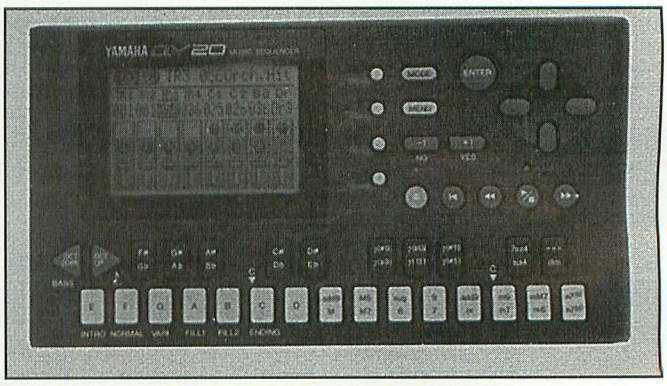
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Connectors for composite and S-Video sources are provided on pigtail that attaches to CardCam-VideoIN PCMCIA video-capture card. In addition to 24-bit still image captures, you can capture motion video streams at up to 15 fps. (Videograph by Tom Benford)



QY20 provides sequencer and tone-generator capabilities and has MIDI IN and MIDI OUT ports, 20-song memory, 100 preset patterns and room for 100 user-defined patterns. Since QY20 is being phased out, you can get it at bargain-basement prices, and it's an ideal way to add General MIDI capabilities to your mobile multimedia setup. (Photo by Liz Benford)

controls. It weighs in at well under 1.25 lb. with six AA alkaline cells installed, making it less of a burden to tote along than the NEC drive.

Since its physical size is considerably smaller than the NEC unit, the KXL-D720 occupies less room in a notebook carrying case. The big news here is that this drive comes with its own PCMCIA SCSI adapter card and cable for attaching it to the drive, which is outfitted with a standard SCSI-2 jack. Cardsofts card and socket service software is also provided. Installing the software is a snap.

Since there's no second SCSI port on the drive, daisychaining is a moot point—unless you locate this drive as the last device in the chain. Because no digital audio output jack is provided, the only available audio output source is the headphone jack, which would have to do double-duty as the line-out source if you want to amplify any Redbook (CD audio) sounds.

CD-ROM Plus Sound

Micro Solutions Backpack CD-ROM Drive with Sound. This plug-and-play quad-speed CD-ROM drive has built-in 16-bit sound. In addition to built-in sound, the drive's strongest points are its quad-speed 600K/s data-transfer rate, ability to attach directly to the parallel printer port of a desktop or notebook PC so that no additional adapter (or PCMCIA card) is require and a cost of less than $500.

This drive employs a front-loading motorized tray for disc serving, which eliminates the need for a caddie. The drive comes bundled with device drivers and audio application software, and it features full Plug and Play functionality for *Windows 95* users and those people who have plug-and-play support built into the BIOSes of their machines.

The internally-connected 16-bit sound card permits both 16- and eight-bit stereo playback and recording, and it can be used independently of the Backpack CD-ROM drive. The audio features 20-voice FM music synthesis, four FM operators and 128 MIDI instruments and is Windows Sound System software-compatible. I/O ports include line and auxiliary input, a microphone jack and line and speaker output jacks. A thumbwheel volume control is provided.

The quad-speed drive is Kodak Photo CD-compatible, and its interface automatically recognizes the Enhanced Parallel Port (EPP) and IEEE 1284 port for faster data transfers. It's also MPC 2-compliant while running on an EPP port, which makes it suitable for thousands of multimedia applications. An optional backpack carrying case for toting the drive is avail- able, at a suggested retail price of $24.99.

Video Capture

Capturing stills and full-motion video has heretofore been almost exclusively a desktop of tower PC bailiwick. Thanks to tremendous strides made in this area of technology, you can now take the ability to do video captures on the road with you. Here are some products worthy of serious consideration.

CardCam-VideoIN PCMCIA Card. I thought it would be just a matter of time before someone came out with a device for capturing still shots and motion video with a notebook PC. Sure enough, Quadrant International's CardCam-VideoIN realtime video-capture card for PCMCIA-Type 2 notebook PCs is designed for just these purposes. It transforms the mundane notebook PC into a powerful multimedia production studio that's capable of recording still images in 24-bit color and displaying moving video sequences in realtime.

Installing CardCam is a very easy and straightforward proposition. You plug the card into a PCMCIA slot on your notebook PC, connect the provided I/O cable to the card and then connect the video source (camcorder, VCR, laserdisc, TV tuner, etc.) to the I/O cable.

The software installs from *Windows* by running Setup from the Install diskette and choosing Express or Custom installation. I elected Express, which set the defaults for the base port address at 380, interrupt at IRQ7 and base-memory address at D800. These choices are customizable by selecting

Custom installation during setup if the Express settings don't work satisfactorily with your notebook PC.

The software creates a QI VidGrab program group that consists of VidGrab, Readme and a CardCam icons. Readme contains last-minute information about the product and details on new features that were added after the manual was printed, such as the new "hot-swap" capability that permits you to plug in or remove the card without re-booting your PC.

You use the CardCam icon to change your configuration settings, if desired, and the VidGrab icon to capture both still and motion video. These operations are virtually identical to those used for the Intel Smart Video Recorder Pro or any other video-capture device that adheres to Microsoft's *Video for Windows* guidelines and specifications.

Video input can be either composite or S-video (S-VHS, Hi-8), since connectors for both are provided on the card's pigtail.

True-color frame grabbing is supported by capturing stills as 24-bit Y/U/V image data and storing it as a standard bitmap (.BMP) or *Video for Windows* (.AVI) file. It should be noted that on-screen display quality is limited by the display capabilities of the notebook PC on which you're doing the captures. For example, my Versa E can display a maximum of only 256 colors at any resolution, even though the captured image is in true color (16-million colors). Saved images will display correctly as true-color video when transferred and displayed on an SVGA-capable system.

Capturing a motion-video stream from a live or taped source can be done at up to 15 frames per second (fps) and up to 320 X 240-pixel resolution. The faster the CPU in your notebook PC, the better your chances of obtaining the full 15 fps without dropping frames. For most applications, 15 fps displays very nicely and provides smooth full-motion video devoid of choppiness. The length of a motion-video capture is limited to available RAM and hard-disk space. You can save multiple motion captures to disk for later editing, joining or other uses.

Since CardCam-VideoIN accepts either U.S. NTSC or European PAL video standard, you're covered even if your multimedia jaunts take you abroad. The Quadrant driver suite's point-and-click controls permit converting captured images from 24-bit color to grayscale, adjusting hue, contrast and brightness, and more.

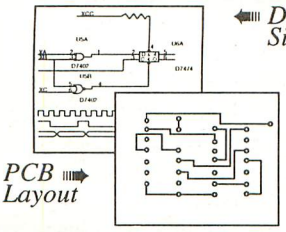
CardCam-VideoIN PCMCIA is just the ticket for any user who wants the ability to capture still or motion video images on the spot directly to the hard drive of his notebook PC for immediate use in multimedia productions/presentations, later editing or transfer to another PC. The device installs without a hitch and does everything its manufacturer claims.

Multimedia To Go

Specialized items really add to the versatility in the multimedia-to-go arena. Here are a few items that deserve a close look.

MIDIman PC/P Parallel and PC/S Serial MIDI Interfaces. If you expect to use your notebook PC for serious MIDI music production, you need a MIDI interface that connects externally.

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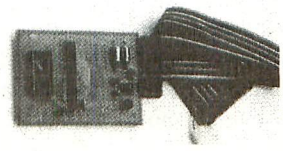
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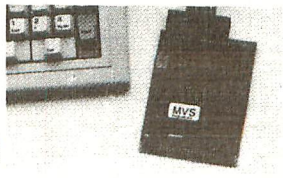
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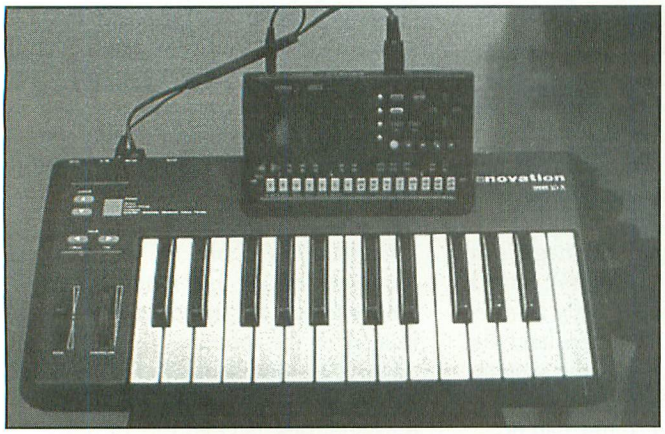
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Novation's MM-10X MIDI keyboard controller shown with Yamaha QY20 inserted and coupled to it—a marriage made in MIDI heaven—has long list of sought-after features and, like QY20, is portable. (Photo by Liz Benford)



MidiCon is a compact, portable 25-note MIDI keyboard that's ideally suited for use with multimedia sound cards or external MIDI tone generators and features velocity sensitivity full-size keys, 250-hour battery life and much more. (Photo by Liz Benford)

MIDIman has two excellent units in your choice of serial or parallel-port models.

Portman PC/P is the parallel model that attaches to any PC's Centronics-type printer port, using a standard printer cable. This leaves the serial port free for using a mouse, which is a major point to consider with the many laptop and notebook PCs that have only a single serial port.

Since PC/P isn't a transparent device, you won't be able to keep your printer connected simultaneously with the interface, unless you have a second parallel port. Universal *Windows* and DOS drivers accompany the interface, and MIDI IN and MIDI OUT ports are provided for connections.

Portman PC/S attaches to a serial rather than a parallel port. As with the parallel version, universal *Windows* and DOS drivers are provided.

Both PC/P and PC/S come with *Windows* help files for *Cubase*, *Cakewalk* and *Mastertracks*. Both versions also feature "smart buffering" to take the load off the software, making them ideal for system-exclusive dumps.

Both MIDIman external interface models come housed in sturdy metal enclosures and are guaranteed for life. Ac power adapters are supplied with them for use with PCs that don't provide the required power at their ports.

Yamaha QY20 Compact Music Processor. The QY20 palmtop Music Sequencer music-production system features a built-in tone generator, sequencer and auto-accompaniment capabilities, all integrated into a pocket-size module that has a very-sophisticated control interface. This compact device measures about 7½"L x 4½"W x 1"D and weighs less than a pound with its six AA alkaline cells installed. It can also be powered by the included ac adapter for extended in-place use, since the battery will last only about 6 to 10 hours under heavy use.

An LCD screen lets you view the controls and settings of various editing and instrument functions. Soft-touch controls are standard, and you can enter individual musical notes directly from the QY20's keypad or from any external MIDI controller, such as the Novation MM-10X covered a bit later. Provided are MIDI IN and MIDI OUT ports, a volume control, line-out and headphone jacks and contrast controls for the LCD screen.

The QY20 uses Yamaha's AWM (Advanced Wave Memory) technology to deliver 100 voices with outstanding sound quality. Eight different drum "kits" are built in. All voices are 16-bit samples of actual instruments, and sound quality is terrific. A built-in 20-song sequencer unit has a 28,000-note capacity, and 32-note polyphony is supported on both record and playback. Hence, intricate scores aren't a problem for the QY20.

Some very impressive sequencer features are incorporated into this tiny unit as well. The sequencer is an eight-track unit that's divided into 24-track groups. Tracks 1 through 4 are for melody/harmony, the remaining four tracks for accompaniment.

You can use the first four tracks with any of the 100 internal voices or eight drum kits that provide 100 different percussion voices from which to choose if you wish to record via the QY20's own two-octave polyphonic micro-keyboard or from an external keyboard that uses the MIDI IN connector.

The sequencer provides 100 preset patterns with six sections—including Intro, Normal, Variation, Fill 1, Fill 2 and Ending—that can be selected and used and has the ability to store up to 100 original user-created patterns. The accompaniment tracks utilize Yamaha's ABC (Auto Bass Chord) accompaniment system that automatically harmonizes the chord and bass tracks according to the chords specified. You can turn off the ABC feature, if desired. The 25 preset chords provide the basic building blocks for songs, and the QY20 can record in realtime or step mode.

Yamaha's QY20 Music Processor is also compliant with the General MIDI standard, as well as its own voicing. Either mode is switch-selectable. Bear in mind that only the first 100 of the 128 GM patches are supported. But since patches 101 through 128 aren't frequently-used instrument sounds, this doesn't pose much of a limitation.

The QY20 is available from mail-order suppliers for about a third of its original list price, since Yamaha has introduced successor models to replace it and it's being phased out of the current product line.

The QY20 will remain one of the most powerful and versatile GM-compliant tone generators for many years to come. You can get a great deal on one by doing some wise shopping.

Novation MM-10X Keyboard Controller. Yamaha's QY20 is such a versatile little device that it's a natural for use with an external keyboard. The Novation MM-10X from Music Industries is the perfect companion for the QY20. It greatly enhances the QY20's play-ability, versatility and practicality and makes an ideal compact portable MIDI controller.

This two-octave velocity-sensitive keyboard comes with a cable adapter for connecting it to QY20. It even has a handy tray built into it for holding the QY20 while in use.

To keep you updated on the status of the MM-10X, a built-in LCD panel provides continuous information on all settings, including MIDI channel, octave, program change, transpose, controller functions and low-battery indicator, to name just a few.

The keyboard is equipped with full-size keys that are transposable over eight octaves. An optional sustain pedal can also be used, since the MM-10X is outfitted with a standard 1/4" input phone jack for this purpose. Some other noteworthy features include velocity sensitivity, a pitch wheel and programmable multi-function controller wheel.

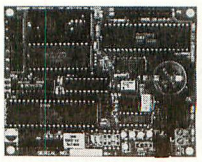
Powered by six alkaline cells, the MM-10X provides an average of more than 80 hours of battery life in normal use. A pair of provided strap holders installs on it. So it can be used as an easy-to-handle remote keyboard controller that can be worn and played guitar-style, if preferred. Since it's battery powered, it's totally portable and can be used with the QY20 virtually anywhere, without having to worry about availability of ac power.

If you're using a QY20 tone generator, you'll find the MM-10X indispensable. If you're using the multimedia capabilities of your PC's sound card and want to use an external keyboard controller for MIDI input, the MM-10X makes an excellent choice for this purpose as well.

Yamaha TG300 Tone Generator. For anyone who does serious multimedia production work that makes extensive use of MIDI music, Yamaha's TG300 is literally an orchestra in a box that packs along easily with your notebook and other multimedia gear.

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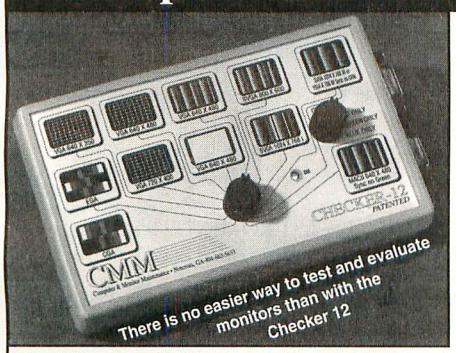
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Yamaha's series of General MIDI-compliant tone generators, the TG300 is far from being outdated or obsolete. Though it's no longer being manufactured, it's still available from many better music outlets and mail-order suppliers at close-out prices. By shopping around, you can get a TG300 for about a third of its original list price, making it a superior bargain for MIDI music production.

The TG300 manages to pack 456 high-quality voices, nine drum kits and an FX (effects) collection into a compact 8⅝" X 10⅛" X 3⅝" unit that weighs less than 4.5 lb. The TG300's sound architecture employs AWM2 (Yamaha's second-generation Advanced Wave Memory) with digital filters. It stores 195 sound waves in its massive 6M of ROM. The acoustic instrument voices and exceptional synth textures are robust and full of ambient "presence," thanks to the unit's 16-bit CD-quality processing.

All voice elements consist of one or two sound elements, and the unit provides extensive editing capabilities with independent envelope and scaling controls for pitch, filter and level that permit you to create your own unique voice patches.

One of the nicest features of this unit is its ability to provide 32-note polyphony with 16-part multi-timbrality. So you literally have instruments of a 16-member orchestra (you select the 16 instruments) at your command. All of the parts and voices are fully editable, and the sound parameters include filter cutoff and resonance, level envelope generator, portamento, MIDI control change assign and MIDI bank-select support.

The TG300s MultiMode is ideal for multi-track MIDI sequencing, and it totally eliminates the need for any other external synthesizer for any scores or projects that require a maximum of 32 notes at any one time. Of course, you could always add another TG300 or any other MIDI device by daisychaining, if you so desire.

For tonal effects to spice up your multimedia audio, it's difficult to beat what the TG300 has to offer, and no sound card can even come close to what the TG300 delivers. Yamaha's custom DSP (digital signal processor) provides a full spectrum of reverb, chorus and variation effects simultaneously.

Products Mentioned

Shuttle Connection Parallel-to-SCSI Interface, $119
Shuttle Technology, Inc.
43218 Christy St.
Fremont, CA 94538
Tel.: 510-656-0180

CIRCLE NO. 95 ON FREE INFORMATION CAR

MIDIman External MIDI Interfaces, $119.95
MIDIman, Inc.
236 W. Mountain St., Ste. 108
Pasadena, CA 91103
Tel.: 818-449-8838

CIRCLE NO. 96 ON FREE INFORMATION CARD

Novation MM-10X Keyboard Controller, $239.95; Novation MidiCon Keyboard Controller $169.95
Music Industries Corp.
99 Tulip Ave.
Floral Park, NY 11001
Tel.: 800-431-6699

CIRCLE NO. 97 ON FREE INFORMATION CARD

TG-300 General MIDI Tone Generator, $895; QY-20 MIDI Sequencer/Tone Generator Module, $649.95
Yamaha Corp. of America
6600 Orangethorpe Ave.
Box 6600
Buena Park, CA 90622-6600
Tel.: 714-522-9011

CIRCLE NO. 98 ON FREE INFORMATION CARD

Bus Toaster PCMCIA SCSI Adapter, $200; .WAVjammer 16-Bit PCMCIA Sound Adapter, $300; Multimedia Combo Sound/SCSI II PCMCIA Adapter, $500
New Media Corp.
Irvine Spectrum
One Technology, Bldg. A
Irvine, CA 92718
Tel.: 800-453-0550

CIRCLE NO. 99 ON FREE INFORMATION CAR

KXL-D720 Portable CD-ROM Drive, $399
Panasonic Communications & Systems Co.
Multimedia Products
Two Panasonic Way, 7D-3
Secaucus, NJ 07094-9984
Tel.: 201-348-7837)

CIRCLE NO. 100 ON FREE INFORMATION CARD

3XP+ (CDR-401) Portable CD-ROM Drive, $415); PCMCIA SCSI Adapter, $119
NEC Technologies, Inc.
1255 Michael Dr.
Wood Dale, IL 60191
Tel.: 708-860-9500

CIRCLE NO. 104 ON FREE INFORMATION CARD

Micro Solutions 4X Backpack CD-ROM Drive with Sound, $499
Micro Solutions, Inc.
132 W. Lincoln Hwy.
DeKalb, IL 60115
Tel.: 800-890-7227

CIRCLE NO. 102 ON FREE INFORMATION CARD

CardCam-VideoIN PCMCIA Video Capture Adapter, $399
Quadrant Int'l.
65 Valley Stream Pkwy., Ste. 250
Malvern, PA 19355-1460
Tel.: 610-251-9999

CIRCLE NO. 103 ON FREE INFORMATION CARD

Multimedia Books by Tom Benford: *Welcome To...CD-ROM*, $19.95; *Welcome To...PC Sound, Music & MIDI* (Book + CD-ROM), $29.95; *Introducing Desktop Video* (Book + CD-ROM), $34,95
Shipping/handling included in price; 10% discount on two books, 15% discount for all three. Checks/money orders only. Send orders to:
Tom Benford
2329 Hwy. 34, Ste. 201
Manasquan, NJ 08736
Tel.: 908-223-2271

The unit can deliver a whole host of effect algorithms, including reverb, chorus, flanger, EQ, rotary speaker and Aural Exciter, which allows you to add spaciousness, stereo depth and "sparkle" with an unlimited amount of control.

The effect types and controls consist of distortion, EQ, chorus, flanger, echo, cross delay, symphonic, rotary speaker, tremolo, auto-pan, phaser, pitch change, auto-wah, exciter, compressor, reverb (Hall, Room1, Room2, Room3, Stage1, Stage2, Plate, WH Room, Tunnel, Canyon, Basement), early reflections (ER1, ER2) and gate reverb.

Power for the TG300 is provided by a supplied 12-volt, 700-mA ac adapter. Audio connections include phone

jacks for right and left mono line out, phono jacks for left and right audio in, and a stereo phone jack for headphones. MIDI connections are all standard five-pin DIN jacks for MIDI IN, MIDI OUT and MIDI THRU. A built-in MIDI interface permits direct connection to the serial port of your PC, eliminating the need for a discrete external MIDI interface on your laptop PC. An eight-pin mini DIN jack is provided for connecting the TG300 to the host PC.

Novation MidiCon Keyboard Controller. If you've been looking for a good portable external keyboard controller that's compact and light enough to take along with your laptop for mobile multimedia gigs, Novation's MidiCon keyboard nicely fills the bill. Designed specifically with the multimedia PC user in mind, MidiCon is a very solid keyboard controller that has all the features you need to do serious MIDI music production, at home or on the go.

The keyboard has full-size keys, a two-octave range, velocity-sensitive response, two on-board switches that provide an additional eight-octave range, pitch and modulation wheels, a sustain (foot-pedal) input with a built-in automatic-polarity feature and one MIDI OUT port. Since the keyboard contains no tone-generating source, there's no need for a MIDI IN port.

The keyboard is powered by alkaline cells that are rated to yield an average useful life of 250 hours. Alternatively, it can be powered by an optional ac adapter. Since strap pegs are also provided on, you can use the keyboard as a strap-on remote controller for mobility around the studio and live performances, wearing it like a guitar.

Accessory items for enhancing MidiCon and/or the MM10X include a carrying case ($29.95) and regulated ac power-supply adapter ($14.95).

If you're into PC sound and want an affordable touch-sensitive keyboard controller that has good action and full-sized keys and packs along easily, this one is for you.

In Closing

Now that the world of multimedia has opened itself up to notebook PC users, the potential for what you can do with it is limited only by your imagination and knowledge. To help you expand your knowledge and stimulate your imagination, I recommend my three books dedicated to multimedia. The first one deals with the CD-ROM. The second covers PC sound, music and MIDI. The third deals with desktop video production. Since the information, tips and tricks contained in all three pertain equally to notebook and desktop PCs, they're a worthwhile read for anyone who is interested in increasing his depth and comprehension of the fascinating and fast-growing field of multimedia.

You can be sure that as more users buy and rely on notebook PCs as their mainstay machines and traveling companions, we'll be seeing many more portable drives, interfaces, audio adapters, combination units, video and MIDI production devices appearing in the coming months. Who says you can't take it with you?



Tom Benford

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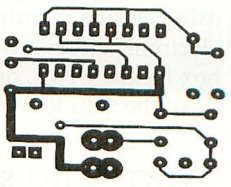
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By Jan Axelson

Fast and Easy Access to Free Technical Data On-Line

The Internet is your key to finding what you need when you need it

There's been no shortage of talk about the Internet and its possibilities. But amid all the predictions and promises, there are some areas in which, right now, the Internet provides truly useful time-and money-saving services. Not surprisingly, one such area is electronics, where many chip manufacturers now offer on-line access to data sheets and other information about their products.

Having data sheets available on-line offers several advantages. You no longer have to wait a week or more for requested documents to arrive by mail. You don't have to pay $20 or more for a data book when you need only a few data sheets. Data stored on-line or on your own disk uses up much less space than paper documents, freeing up your bookshelves for other things. And when you're trying for a source for a particular chip, on-line databases of manufacturers, chips and distributors make the search easy.

Besides data sheets, you can find on-line parts catalogs, circuit ideas and other information that was formerly available only on paper. And Usenet newsgroups and electronic mailing lists are a great way to network with others around the world who share your interests.

This article is a guide to finding and using on-line information relating to electronic circuits. See the Web Links box for the URLs, or on-line addresses, of the sites to which I refer.

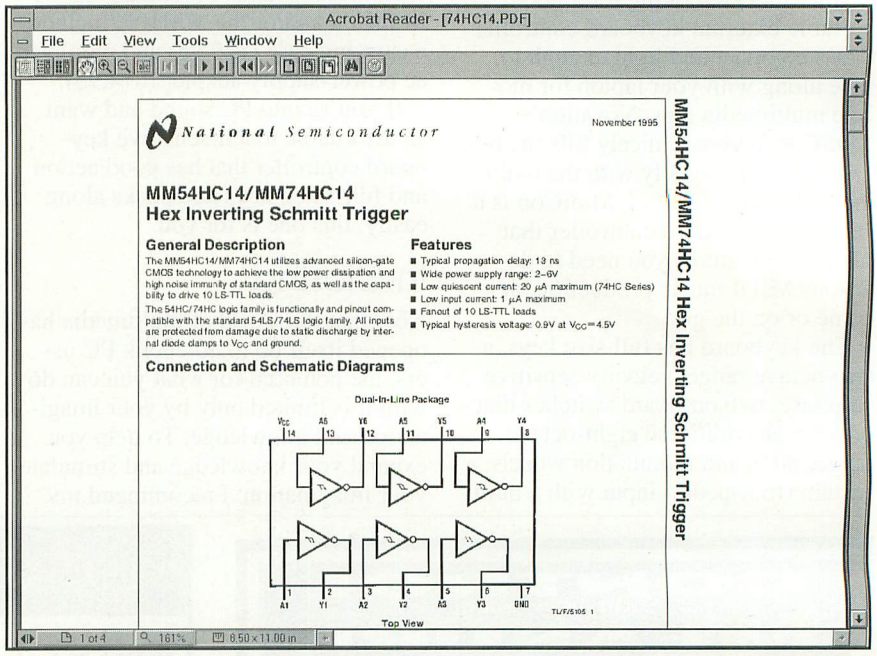


Fig. 1. Data sheet for 74HC14, downloaded in .PDF format from National Semiconductor Web site and displayed with Adobe *Acrobat*.

Using Data sheets

If you design, build, repair and/or experiment with electronic circuits, you probably have at least a small collection of manufacturers' data books. Data books contain collections of data sheets, each sheet filled with specifications and other essential information about a particular chip, or integrated circuit (IC). In fact, it's difficult to do much of anything with an IC, unless you have the data sheet to which you can refer. It's on data sheet that you'll find answers to basic questions like these:

What's the pinout or function of each pin on the device?

What power-supply voltage does it require?

How much current will it draw?

For logic chips, what are the required input and output voltages?

For operational amplifiers, what are the minimum gain and frequency response?

For computer chips, what are the addressing timing and input/output characteristics, and what's the instruction set?

Many manufacturers also provide applications information, including example circuits and detailed explanations of the chip's operation. This information may be on the data sheet or in separate application notes.

On-line Data

Manufacturers still publish data sheets on paper, of course, but many have put at least some information on-line as well. Doing so provides advantages to both the manufacturer and the user.

For the manufacturer, every data sheet a customer finds on-line is one less that must be paid for to print,

stock and ship. (Although some companies do charge some customers for data books, I think all would prefer to focus on selling components, not data books.) For users, having data available on-line means they can obtain the information whenever they want—almost instantly—and it costs only the normal charges for accessing the Internet.

To locate and download data sheets, you need an Internet connection and a browser for accessing the World Wide Web. (Some information is also available via FTP.) To view documents, you also need the appropriate viewing software, available free on the Web.

• ***File Formats.*** Data sheets typically contain text, tables and line drawings. The file format used to store a data sheet must be able to handle all of these. Because users of the data will be operating with a variety of computers and operating systems, files must be in a format that's view-able on many different systems.

There's no one standard format for on-line data, but the most-popular by far has been Adobe Systems' Portable Document Format (.PDF), which you can view with Adobe *Acrobat* software. Another common format is Postscript (.PS). And some information is available in other formats, including HTML, SGML, word-processing formats like Microsoft *Write* and *Word* or plain ASCII text. To view a document, you need software that recognizes the format and knows how to display or print it.

• ***Adobe* Acrobat *.PDF Format.*** Intel and National Semiconductor are two companies that have made data sheets available in .PDF format. To view a .PDF document, you need Adobe System's *Acrobat* viewer software. You may already have *Acrobat* because it comes with some software products, such as Inset's *Hijaak Graphics Suite*. You can also download it free from Adobe and other Web sites. Many companies include links to Adobe's site on their Web pages to make downloading the software as easy as possible.

As the name suggests, .PDF format is designed as a portable format you can use for viewing documents on a variety of systems. There are *Acrobat* readers for *Windows*, MS-DOS, Macintosh and Unix. The .PDF format is based on Adobe's Postscript page-description language.

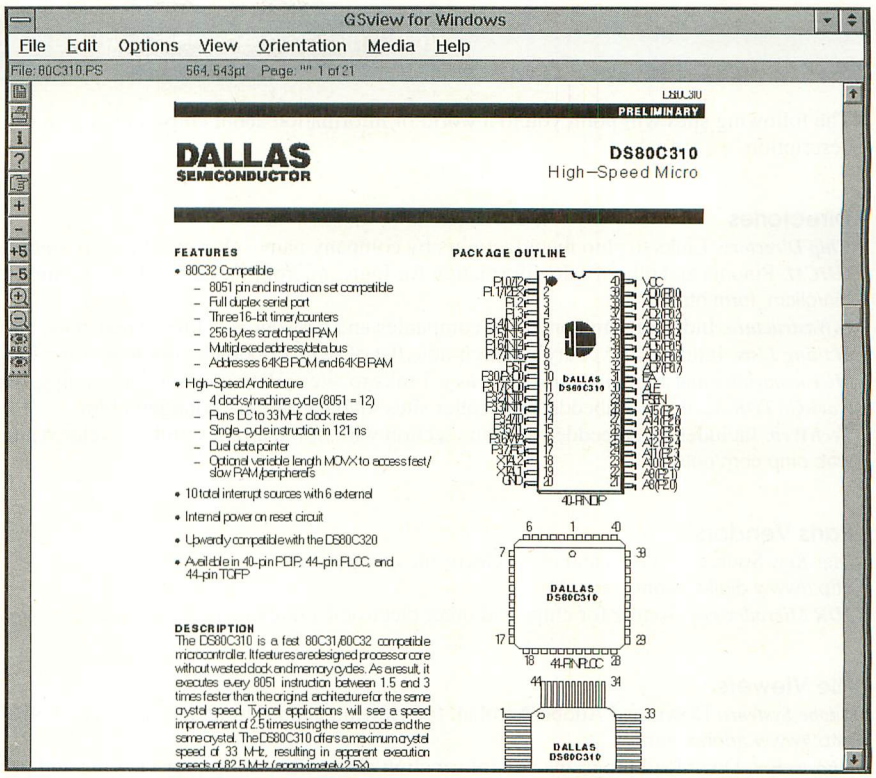


Fig. 2. Data sheet for DS80C310 microcontroller, downloaded in .PS format from Dallas Semiconductor Web site and displayed with *GSView*.

With the *Acrobat* software, you can open a .PDF document, view it on-screen and print it. Except for occasional minor differences in fonts, a data sheet viewed in *Acrobat* looks just like the printed version, as Fig. 1 reveals. Documents are stored as pages, as in a book. You can page through the document and zoom in or out for a comfortable viewing size.

If you want a paper copy of a document in .PDF format, you can print it from *Acrobat*. You can also copy text and graphics and paste them into documents you create in other applications.

One very-useful feature of most electronic documents is the ability to search for text. *Acrobat* offers this as well. For example, you can search for "power supply" or "V_{cc}," or whatever topic interests you, without manually paging through the entire document. *Acrobat* even finds text in graphics, tables and captions.

To encourage sales of its related products, Adobe offers the *Acrobat* viewer free. These include software for creating .PDF files and adding notes, navigation links and security to existing files. Adobe's Web site has information on these.

Although you can use *Acrobat* to search for text in an individual document, the text in *Acrobat* documents isn't search-able with conventional text-search utilities. For example, PC Tools' SmartFind utility searches multiple files or an entire disk for occurrences of a word or line of text you specify. If you store a lot of information on-disk and tend to forget what's stored where, a utility like this is extremely useful! Be advised, however, that search utilities won't find the text in .PDF documents. To search multiple .PDF documents at once, you need two products from Adobe: Catalog to index your documents and Search to perform the search operation.

• **Postscript *(.PS) Format.*** *Postscript* page-description language, or PDL, is another format used for on-line data sheets. *Postscript* is actually a programming language, the most common use of which is to send text and graphics to a printer or other output device. *Postscript* files are computer programs, and a *Postscript* printer contains an interpreter program that

Web Links to electronics-related sites

The following sites will point you to a world of information about chips and how to use them. The Internet address follows each description.

Directories

Chip Directory. Links to chip manufacturers by company name, chip number and function: http://www.xs4all.nl/~ganswijk/chipdir/
GIICM. Pinouts and other basic information for logic, microprocessor and other chips: http://www.paranoia.com/~filipg/HTML/cgi-bin/giicm_form.html
Infrastructure. Index of semiconductor companies and a resource list to related sites: http://www.infras.com/default.html
Mailing Lists. Indiana University's search-able list of over 12,000 electronic mailing lists: http://scwww.ucs.indiana.edu/mlarchive/
Microcontroller and Microprocessor Directory. Links to sites relating to computer chips: http://www.cera.com/micro.htm
Navi-GATOR. Links to embedded controller sites: http://www.cera.com/gator.htm
TechWeb. Includes an embedded systems section with news, articles, links to related sites, and forums for discussion: http://techweb.cmp.com/eet/

Parts Vendors.

Digi-Key. Source for chips and other electronic components:
http://www.digikey.com/
JDR Microdevices. Source for chips and other electronic components; http://www.jdr.com/JDR

File Viewers

Adobe Systems. Download Adobe Acrobat, for viewing and printing data sheets and other files in PDF format.
http://www.adobe.com/
Ghostscript. Download programs and information about Ghostscript, for viewing and printing data sheets and other files in Postscript format: http://www.cs.wisc.edu/~ghost/index.html
PCIS format. Download SoftQuad's Panorama Free, for viewing files in SGML and PCIS formats:
http://www.ncsa.uiuc.edu/SDG/Software/WinMosaic/Viewers/panorama.htm

Selected Semiconductor Companies (Chip Directory above lists dozens more)

Dallas Semiconductor: http://www.dalsemi.com/
Intel: http://www.intel.com/
Motorola: http://www.mot.com/
National Semiconductor: http://www.nsc.com/
Texas Instruments:
http://www.ti.com/

Newsgroups About Electronics

Most newsgroup descriptions are from the List of Active Newsgroups, Parts 1 and 2, available at:
ftp://rtfm.mit.edu:/pub/usenet/news.lists/

Computing

alt.comp.hardware.homebuilt	Do-it-yourself computer hardware projects
comp.arch.embedded	Embedded computer systems topics.
comp.robotics.misc	All aspects of robots and their applications.
comp.sys.ibm.pc.hardware.cd-rom	CD-ROM drives and interfaces for the PC
comp.sys.ibm.pc.hardware.chips	Processor, cache, memory chips, etc.
comp.sys.ibm.pc.hardware.comm	Modems and communication cards for the PC
comp.sys.ibm.pc.hardware.misc	Miscellaneous PC hardware topics
comp.sys.ibm.pc.hardware.networking	Network hardware and equipment for the PC
comp.sys.ibm.pc.hardware.storage	Hard drives & other PC storage devices
comp.sys.ibm.pc.hardware.systems	Whole IBM PC computer and clone systems
comp.sys.ibm.pc.hardware.video	Video cards and monitors for the PC

General Electronics

sci.electronics.basics	Elementary questions about electronics
sci.electronics.cad	Schematic drafting, printed-circuit layout, simulation
sci.electronics.components	Integrated circuits, resistors, capacitors
sci.electronics.design	Electronic circuit design
sci.electronics.equipment	Test, lab and industrial electronic products
sci.electronics.misc	General discussions of the field of electronics
sci.electronics.repair	Repairing electronic equipment

executes the programs in the files it receives.

You can view or print a *Postscript* file with any device that can display or print *Postscript*. The *Postscript* language is a product of Adobe Systems, but clone interpreters are available from other sources and seem to work well enough for viewing data sheets in which minor variations in appearance of a document aren't important.

If you have a *Postscript*-capable printer, you can print a .PS file with the DOS COPY or PRINT command. For example, the command copy *filename.ps* lpt1 causes the *Postscript* printer at LPT1 to print the document stored in *filename.ps*.

If you don't have a *Postscript* printer, you can still view and print .PS files, using *Postscript*-viewer software. One free source uses Alladin Enterprises' *Postscript* clone, *Ghostscript*, available for *Windows*, MS-DOS, OS/2, Macintosh and Unix. To view files with *Ghostscript*, you need four files: an initialization file, an operating-system file, a set of fonts and the viewer. All are available free for non-commercial use.

GSview enables you to view documents stored in *Postscript* format, as illustrated in Fig. 2. As with *Acrobat*, you can search for text, though *GSview* doesn't highlight the located text. It just displays the page that contains the text for which you searched. Unlike *Acrobat*, *GSview* doesn't find text in graphics.

You can also use *GSview* to print .PS documents on non-*Postscript* printers. And you can copy pages as bitmaps and paste them into other documents. If the file contains text stored as *Postscript* strings (surrounded by parentheses), you can copy the text to a file. Not all files store text in this manner, however. For example, a search on one of Dallas Semiconductors' data sheets found no text at all. This also means that you can't use other search utilities to find text in these files.

You might think you can use your desktop-publishing program to view a *Postscript* file. Many programs, including Corel's *Ventura Publisher* and Frame Technology's *Framemaker*, permit you to import *Postscript* files into documents. But there are a couple of limitations to using a desktop-publishing program as a *Postscript* file viewer.

First, the programs usually require the file to be in *Encapsulated Postscript* (.EPS) format. Because .EPS files must be on a single page, you have to split a multiple-page .PS file into separate single-page files before

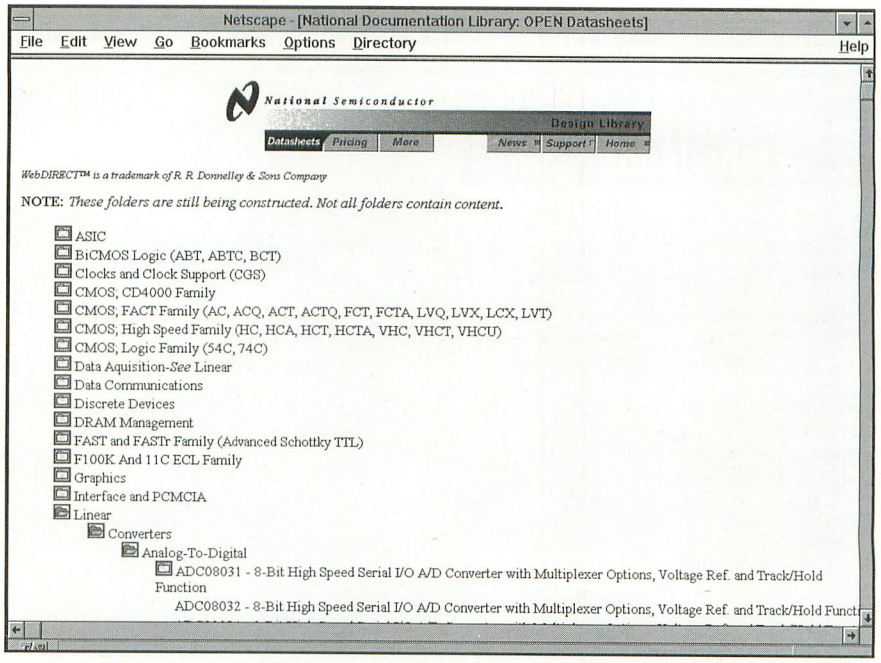
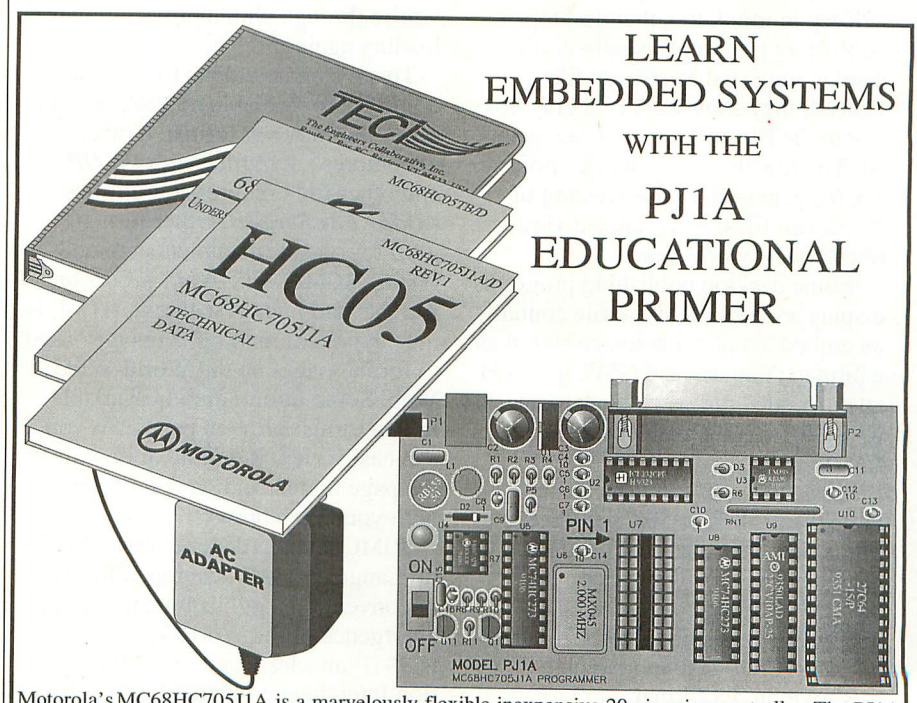


Fig. 3. National Semiconductor stores on-line data in a system of folders.



Motorola's MC68HC705J1A is a marvelously flexible inexpensive 20 pin microcontroller. The PJ1A connects to a PC serial port and provides the fastest, easiest way to program these devices. The PJ1A EDUCATIONAL PRIMER includes the programmer, PC control software and manual, Motorola Technical Data book, Understanding Small Microcontrollers textbook for learning 68HC05 assembly language programming, a PC based cross assembler and manual, example programs, schematic diagrams and an erasable J1A chip for $299.00. PJ1A programmer only is $169.00.

TECI The Engineers Collaborative, Inc.
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TEL: (802) 525-3458
FAX: (802) 525-3451
E-Mail 103006.612@compuserve.com

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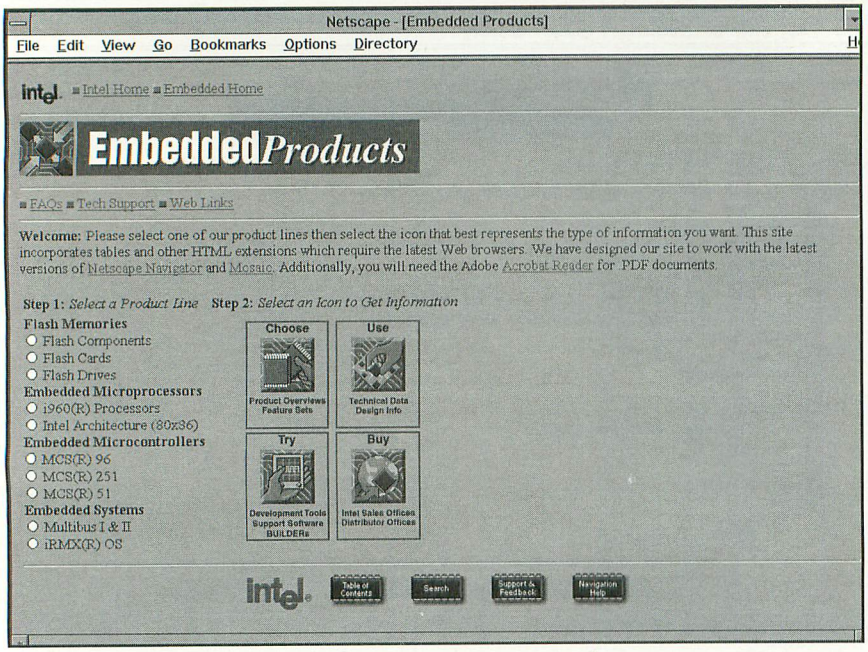


Fig. 4. Embedded-products section on Intel Web site.

importing them. .EPS files must also have a special header and bounding box, which you must add to convert a .PS file to .EPS.

Keep in mind, too, that desktop-publishing programs usually don't display imported *Postscript* files. Instead, they show an *X* or a gray box where the file will appear when printed. To view the file, you must print it. So, for general-purpose viewing of *Postscript* files, a specialized viewer like *GSview* works best.

(Some desktop publishing programs display an .EPS file if the file contains an embedded preview image stored as a bitmap. You can use *GSView* to add an embedded preview image to an .EPS file. *GSView* also converts .PS files to .EPS.)

Both .PDF and .PS files can be large, using 15K to 50K per page. Some data sheets consist of just a few pages, but Intel's 35 pages on the 8xC251 takes up 536K in a .PDF file, and Dallas Semiconductor's 21 pages on the 80C310 take more than a megabyte in .PS format.

As you can see, if you start collecting data, you can fill a disk pretty quickly. Of course, you can always print the data sheets and then delete them from your disk. Then your only problem is where to file all the paper copies.

Another approach is to view the documents on-line as you need them, and don't save them at all. Or you can download and save documents as you need them, but delete them when you're through with a project, downloading again if the need arises.

To save on download time, some .PS files are available in .PSZ, or compressed *Postscript* format. You can uncompress .PSZ files with *PKZIP* and other file-compression utilities.

• ***Other File Formats.*** Other formats used for on-line documents include HTML, SGML/PCIS, word-processor formats and plain ASCII text. HTML is the "hypertext markup language" used to format pages on the World-Wide Web. Some information is available in this format on Web pages. So you can easily view it on-line or download the page to disk and view it off-line with your Web browser.

SGML (Standard Generalized Markup Language) was developed for use in conventional publishing, before the emergence of the World Wide Web. PCIS (Pinnacles Component Information Interchange Standard) is a subset of SGML that's intended for presenting and using semiconductor data. PCIS is the result of the work of a number of semiconductor companies that formed a group called Pinnacles to develop the standard.

PCIS is similar to HTML, but instead of HTML's generic "Heading" tags and text entries, PCIS uses standard datasheet headings like "Recommended Operating Conditions." PCIS also uses standard labels for power-supply voltages and other specifications. This way, all data sheets follow a similar format, and other software products can easily find and use the information.

For viewing PCIS files, the *Panorama Free* viewer is available for free downloading. However, few companies seem to be using PCIS, and those that do, like Texas Instruments, are adding .PDF files by popular request.

Files stored in word-processor format are easy enough to view if you have the word processor or if your word processor can import the specific format.

Plain text is the simplest of all. Many FAQs (lists of frequently asked questions) are simple text files, which you can view with any word processor, including *Windows* Write and Notepad.

Sample of Offerings

Here's a look at what some of the chip companies are offering.

• **National Semiconductor** has more than 5,000 data sheets stored as .PDF files (an example of which is shown in Fig. 3). For many devices, there's also a summary in HTML format. When you access the site, you're asked to register and provide a password, but you don't need the password to access the data sheets.

• **Intel** has a huge site, with data sheets stored as .PDF files. The site has sections on Processors and PCs, Communications and Networking, PC Developer Support and Embedded Design Products (see Fig. 4).

• **Dallas Semiconductor** has short versions of data sheets in HTML, and long versions in .PS (*Postscript*) format.

• **Motorola** has some data available on-line as .PDF files, with more promised in the future. There's also a literature catalog, information on Motorola's Fax-back service, access to the many files available on Motorola's long-standing BBS and archives of the on-line mailing lists on a variety of topics relating to Motorola products.

• **Texas Instruments** invites you to design a custom Web page that automat-

ically presents news in the areas of interest you specify. Data sheets are in PCIS and .PSZ (compressed *Postscript*) formats, with .PDF promised in the future. To view TI's data sheets, you must register, then wait for an address-validation code to arrive in the mail. After entering your validation code, you must provide your username and password each time you want to view or download data sheets. TI states that the reason for requiring the validation code is U.S. government regulations that prohibit exporting technical data to certain countries. Other companies don't require a code, however.

Of course, like everything on the Web, the offerings are constantly changing and expanding. Companies that weren't on-line at this writing may well be there now, and others may have expanded what they offer.

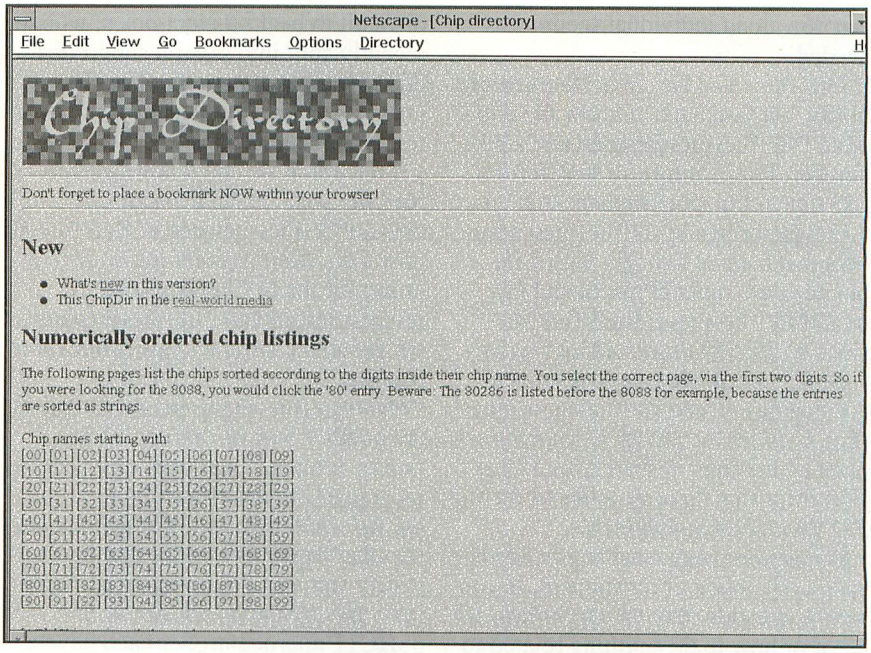


Fig. 5. You can search Chip Directory for manufacturers and components.

Tips for Searching

One of the great things about the World Wide Web is the ability to search for a word or combination of words using a search engine like *Lycos* or *Yahoo*. For tracking down data sheets, there's an even easier way, using the Chip Directory (Fig. 5) site devoted to cataloging information about integrated circuits.

Chip Directory is largely the personal project of Jaap van Ganswijk of The Netherlands, with help from many contributors. The directory has been on-line and growing since early 1995.

An index of manufacturers lists names, addresses and telephone numbers, with links to the company's home page and FTP site, if they exist. When I checked, the directory listed 95 companies with Internet sites, plus contact information for many others not yet on-line.

If you know a chip's part number, you can search for companies that offer it. For example, a search for the 8032 microcontroller led me to links to Dallas Semiconductor, AMD, Intel and Philips. If you're looking for a chip to perform a particular function, you can search by function.

The parts listings aren't yet as complete as you'll find in The *IC Master* (described below), but it's a simple and quick starting point. For example, a search for real-time clock chips turned up 56 entries, most from Dallas Semiconductor and Motorola. *IC Master* also lists chips from Harris, Samsung, SGS-Thomson, Benchmarq, Toshiba and others.

More On-line Sources

In addition to manufacturers' data sheets, plenty of other information is available on-line. Some parts vendors now have Web sites at which you can search their catalogs, request a printed catalog and sometimes place orders.

Digi-Key has its entire catalog on-line in *Postscript* format. Again, an advantage to the electronic catalog is that it's easy to search for a particular part. There's no need to manually page through the catalog or search the index. Though the complete Digi-Key catalog runs to more than 18M, you

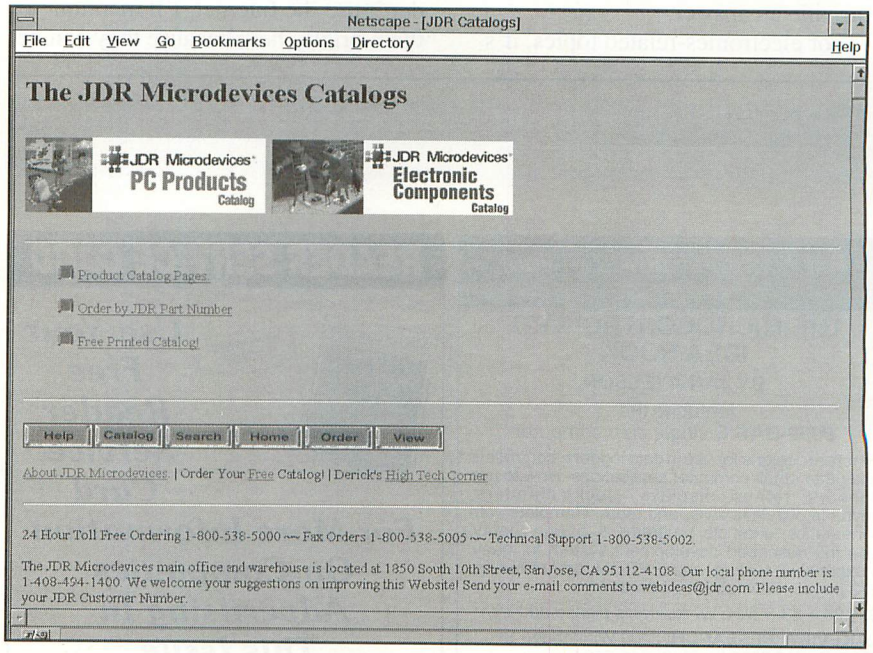


Fig. 6. JDR Microdevices is one of several parts vendors with an on-line catalog.

can download individual sections as needed.

Digi-Key also has an on-line search utility, but you have to know the complete Digi-Key or manufacturer's part number. For example, to search for a 555 timer chip, you might search on *555.* This brings up a list of part numbers that happen to begin with *555,* but none are timer chips. Searching on *LM555,* however, finds five versions of the 555 timer and their prices.

JDR Microdevices is another vendor that has placed its catalog on-line (Fig. 6), with the ability to search for parts by number. A search for *555* at JDR brings up three versions of the 555 timer, along with prices.

• ***Newsgroups.*** Maybe what you need isn't a data book or component. If you have a question about a part or how to use it or how to do anything related to electronic circuits, a good place to start is the Internet's popular on-line discussions called Usenet newsgroups. Each newsgroup is devoted to a specific topic, and most newsgroups are open to anyone who has Internet access and newsgroup-reader software. Readers are included in many Web browsers, or you can use a separate newsreader program or access the groups from one of the commercial on-line services.

You can learn a lot by browsing groups on topics that interest you. If you have a question, there's a good chance that someone in the group will provide an answer.

For electronics-related topics, it's difficult to beat sci.electronics, which recently split into several subgroups due to increased activity. The Newsgroups box lists these and other electronics-related groups.

To learn more about newsgroups, read the posts in the newsgroup news.announce.newusers. Before you post a question or other message to a group for the first time, read the group's information file that explains the group's charter and guidelines for posting.

• ***Mailing Lists.*** Electronic mailing lists are another way of sharing information on a topic. Every message sent to a list goes out automatically to all of the list's subscribers. Mailing lists are popular for narrow topics that don't justify setting up a newsgroup. Parallax's Basic Stamp and Motorola's 68HC11 microcontroller each have a mailing list. Unlike newsgroups, which require some effort to start up and convince providers to carry, anyone can set up a mailing list by paying a fee to a provider, and anyone with e-mail access can join.

Indiana University has a searchable database of more than 12,000 mailing lists, with information on how to join each.

Other New Ways to Get Data

A couple of other new ways to distribute data and product information don't use the Internet. I'll mention them briefly here because they can be useful and handy alternatives to conventional printed documents.

Some data is available on CD-ROM or floppy disk. This format doesn't have the instant availability of on-line information because, as with printed documents, you must order the product and wait for it to arrive. But like other information stored electronically, CD-ROMs permit you to easily search for information, and CD-ROMs don't use hard-disk space, just a little shelf space for storage.

Hearst's *IC Master* is one example of information now available on CD-ROM. *IC Master* has been published for years as a set of hard-copy tomes. The volumes contain an enormous, comprehensive listing of chips by device number and function, plus a manufacturers' directory and some applications notes. The set is now available on CD-ROM, along with a search utility, but you pay a big premium for the CD-ROM format, with the paper version at $185 and the CD ROM at $495. *IC Master* is available from Digi-Key and other vendors.

Other companies have put device data, device-selection utilities and design software on disk.

Yet another way of distributing information is via a Fax-back system, which faxes documents on request, without requiring a computer at all. You dial the faxback number on any telephone. A menu instructs you to use the keypad to enter a catalog or document number you want faxed to you and your fax's telephone number. After you hang up, usually within minutes the system faxes you the documents you requested.

Some Web sites have information on Fax-back systems for data sheets and other product information.

Moving On

Your comments are invited. You can reach me at jaxelson@mailbag.com.



Jan Axelson

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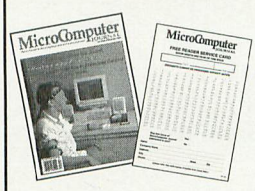
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By Steven Sweet

IBM's OS/2 *Warp* Version 3.0

A new and improved full-featured 32-bit operating system for the masses

We'll most likely remember 1995 as the year in which the battle of the 32-bit operating systems for our desktop PCs really got under way, with IBM OS/2 *Warp* Version 3.0 and Microsoft *Windows 95* girding for the battle of the decade. Though OS/2 *Warp* had been available since early winter 1994 in one form or another, in August 1995, Microsoft joined the fray with its *Windows 95* 32-bit operating system that it hopes will replace the traditional DOS/*Windows* environment.

While Microsoft's *Windows 95* has been a blockbuster in terms of sales and media coverage, IBM's OS/2 *Warp* kept chugging along almost unnoticed. Although sales numbers of the former are monumental (and even the latter is high), we don't really know how many people are actually using the new 32-bit operating systems. Most people I know still use the 16-bit DOS/*Windows* 3.1 operating environment, waiting for the bugs and software/hardware conflicts to be resolved, not to mention availability of desirable 32-bit software.

Will IBM's OS/2 *Warp* get a strong toehold in the OS wars as more-meaningful 32-bit software moves into the front lines and IBM bundles its newly-acquired *Lotus Notes* with it? Or will, by sheer momentum, *Windows 95* totally smother it? Let's examine OS/2 to see its roots and how it evolved to the present time. It has many advocates and deserves your attention.



Setting the Stage

In this article, I focus on OS/2 *Warp* 3.0. I'll give you a realistic view of the cost in time and money you should be prepared to invest. I'll also discuss some solutions to setup problems you may encounter while upgrading your current operating system to the OS/2 *Warp*, a true 32-bit multitasking operating system. Finally, I'll outline the practical 32-bit applications included with IBM's OS/2 *Warp* package and some that are currently available from other vendors.

The 32-bit operating system brings to PC/compatibles the ability to have many programs up and running simultaneously, a facility Macintosh users have had for some time. You've probably become accustomed to using your PC for word-processing, database, spreadsheet, graphic arts, telecommunications and desktop publishing applications and possibly even a few games on the side. Multimedia production and presentation software has gained popularity on today's fully-equipped multimedia PC. But keeping up with the various enhancements in software has become more demanding of a PC's operating system and hardware.

Software on a 486 PC with a 16-bit DOS and/or *Windows* 3.1 operating environment runs nicely on one task at a time. We're becoming more dependent on today's software and beginning to expect more from it. Perhaps while a lengthy document is printing, a spreadsheet is recalculating, an image is rendering, a disk is formatting, a file is coming in from an on-line database or a fax is arriving, you'd like to be able to do perform another task on your PC during the wait. Upgrading to a 32-bit operating system like OS/2 *Warp* 3.0 will let you take full advantage of the native 32-bit multitasking architecture design into the 486 or Pentium processor on a stable PC platform.

The hardware a 32-bit operating system needs is becoming less expensive every day and is readily available, even as an entry-level PC. Prices for the latest technology have tumbled to the point where a basic 486DX/33 with 8M of RAM, 540M hard drive and 14" super-VGA video monitor costs less than $1,000. You can pick up a full-featured Pentium PC for less than $1,400. Both 486 and Pentium PCs have much more power than you may be using, if you're still using the standard DOS 2.1 through 6.2 and *Windows* 3.0, 3.1 or 3.11 operating environments.

DOS and *Windows* environments support single task processing. *Windows* 3.1 pretends to "multitask" by switching between launched applications, but it slows down and, in some cases, stops processing one application while the other is on-screen and working. If a troublesome *Windows* application displays the dreaded "General Protection Fault" (GPF) error message, the PC will stop in its tracks. Both operating platforms can often result in a complete system crash or lock-up if one application runs into problems, such as a memory or device conflict.

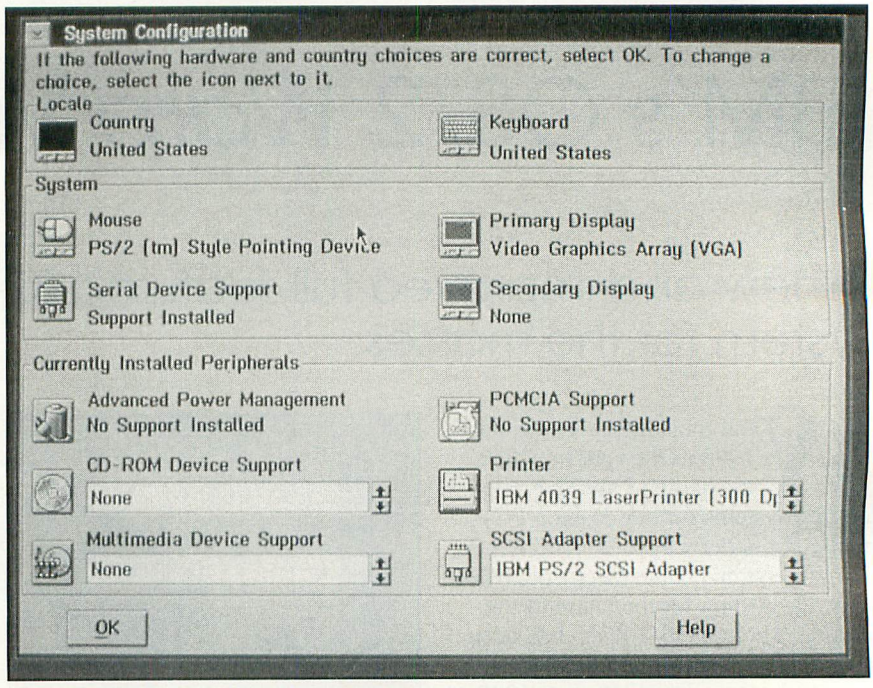
OS/2 shatters the 640K memory

limit of DOS with its flat or linear-memory model that gives each application up to 48M of combined expanded or extended memory without breaking the memory into segments. The result is no "Out of Memory" error messages.

One of *Warp*'s best features is a powerful memory manager that enables the OS to use all available RAM in a PC to set up as many as 240 separate Virtual DOS Machines (VDMs), each able to run independent 16-bit DOS and *Windows* sessions. This lets you safely run simultaneous DOS and *Windows* 3.1 and 3.11 or native OS/2 applications in a "crash-proof" environment. If one application fails, it won't bring down the entire system, allowing other applications to continue running without interruption. (*Windows 95* sets up 16-bit applications by having them share the same memory segments other applications are using, which can lead to memory conflicts and result in system crashes or lockups.)

Each DOS or *Windows* application is set up with its own VDM that contains Session Setting buttons to let you configure parameters. Most applications shouldn't require adjustment in system parameters. But if fine-tuning is needed, these parameters are presented as a series of categories that are accessible when the Settings Notebook Session Settings button is activated, which is available for each application. This permits separate DOS device-driver configurations in the CONFIG.SYS and AUTOEXEC.BAT files for each VDM. The WIN-OS2 part of this feature isolates troublesome *Windows* applications in their own private sessions that you can then preemptively multitask. Since a finely-tuned VDM configuration is something worth saving, you can retain its parameters in the Print-to-File option and then reload it later to replicate the configuration.

Besides easily installing and running any 16-bit DOS, *Windows* 3.1 and 3.11 and native 32-bit OS/2 applications, *Warp* has been significantly enhanced with full Win32 1.0 and 1.1 application support, using the Win32 Application Peripheral Interface (API) drivers to run some 32-bit *Windows* programs. Thus, non-multithreaded Win32 applications written to be portable across the *Windows* 3.1,



Screen capture of OS/2 *Warp* 3.0 during installation.

Windows NT 3.5 and *Windows 95* operating systems will run under *Warp*'s WIN-OS2 environment. Simply install a Win32 application from within an Enhanced Mode WIN-OS2 session (WIN_RUN_MODE parameter set to Enhanced Compatibility). Then shut down and restart the WIN-OS/2 session. The Win32 application will run like any other *Windows* program. Be advised that *Warp* currently doesn't support Win32 applications specifically written for *Windows NT* or *Windows 95*.

Multithreading is another unique feature of OS/2, permitting applications to work behind the scenes. Multithreading occurs when you wish to simultaneously execute internal functions of an application, such as printing, re-pagination or spell-checking on a word processor. It's especially useful with 32-bit communication packages, in which concurrent functions help speed data flow to permit a PC to send data through one serial connection and receive through another, and still allow another task to be completed.

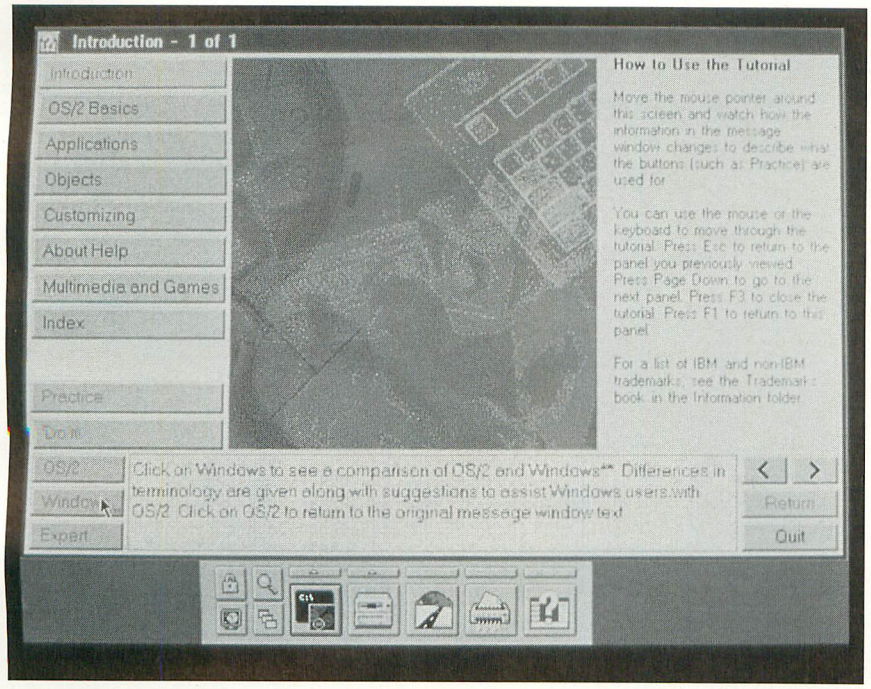
Background

IBM introduced Operating System 2 (OS/2) 1.0 in 1987, two years after Intel introduced its 80386 CPU. Designed as an alternative 16-bit operating system, it offered extremely limited support for existing DOS applications and none for *Windows* applications. Its primary target was corporate PCs that involved networking and proprietary applications.

OS/2 1.0 was the first attempt to leverage the protected mode of the Intel x86 CPU architecture. The result was a previously unheard-of 16M address space for applications and operating-system code and true preemptive multitasking that Intel's 16-bit Memory Management Unit (MMU) was designed to provide. When first introduced, it was hampered by very-high PC platform resource requirements and lack of device-driver support.

Version 1.1 followed with a graphical user interface (GUI) with overlapping windows and icons that could be moved. This was the introduction of the Presentation Manager (PM) to developers and users that has remained as the heart of OS/2 to this day. Today's OS/2 applications are really PM applications. Application Peripheral Interface (API) calls they make are serviced by PM subsystems, and all interaction with the system operator transpires through PM-provided facilities.

OS/2 1.2 featured a revised 3D look, new File Manager applications and the High Performance File Sys-



Screen view of OS/2 *Warp*'s on-line tutorial.

tem (HPFS). HPFS features long file-name support of up to 254 characters, resistance to file defragmentation, faster and easier reading and writing of files (up to 10 times that of the FAT) and a better disk space-allocation scheme than the FAT system that's used in the DOS and *Windows* environments.

In 1989, Microsoft and IBM announced a strategy that supposedly would limit DOS and *Windows* to low-end PCs, reserving OS/2 for high-end PCs and minicomputers. In 1989, OS/2 1.3 appeared, with an improved PM GUI front end to take advantage of the new Intel 80486 microprocessor, as well as the 80386 CPU.

OS/2 1.3 included Adobe Type Manager (ATM) technology for smoother font scaling and better printed output; a Dual Boot feature that let a user to start his PC with DOS or OS/2; a choice of the FAT or HPFS filing format for the hard disk; running DOS and/or OS/2 applications concurrently and independently (true multitasking); the REstructured eXtended eXecutor (REXX) powerful OS/2 procedures programming language; 16M of real memory addressability with access to virtual memory, if needed; "drag-and-drop" icon features; and extensive communication and networking capabilities. It offered better device-driver support, a smaller memory "footprint" and enhanced DOS-application support—but still no *Windows*-application support.

Version 1.3 is still viewed by many people as the one in which IBM finally prevailed and was by far the most successful of the 1.x derivatives. It can still be found on many platforms on which mission-critical and/or vertical applications are used.

By 1990, Microsoft and IBM severed ties in creating a 32-bit OS. IBM would take over development of the OS/2 32-bit OS, while Microsoft would develop *Windows NT* ("NT" stands for New Technology) as a *Windows*-based 32-bit OS. (*Windows 95* is partially 16-bit and partially 32-bit technology.)

In March 1992, IBM introduced OS/2 2.0 as a 32-bit OS for the PC. It included the object-oriented drag-and-drop Workplace Shell GUI front-end with full support for DOS and OS/2 applications, limited support for *Windows* 3.0 applications and virtually no support for *Windows* 3.1, which was released by Microsoft in April 1992. Actually, OS/2 2.0 was a mixture of a 16-bit Presentation Manager and Workplace Shell GUI module and a 32-bit OS and file-system module. Anything to do with multimedia applications could be supported only with additional purchase of the Multimedia Presentation Manager for OS/2 add-on.

OS/2 2.0 lacked the 32-bit graphics engine needed to work at the promised speed. During the fourth quarter of 1992, release of a OS/2 2.0 *Service Pack* corrected that deficit.

By May 1993, IBM started pulling it all together in its release of OS/2 2.1, providing an enhanced version of the 32-bit operating system with the Workplace Shell GUI for Intel-based 386 and 486 PCs that offered full seamless support for DOS 5.0, *Windows* 3.1 and OS/2 applications; the 32-bit graphic engine with a limited variety of high-resolution graphic-card drivers; Adobe and TrueType fonts; built-in multimedia features; PCMCIA 2.0 credit-card-size adapter card and an Advanced Power Management feature for longer battery life in laptop PCs.

Version 2.1 also enhanced the faster and more-efficient HPFS filing format by enabling one to keep the normal DOS FAT filing format and/or HPFS filing format. WIN-OS2, the *Windows* part of OS/2, was also updated to include *Windows* 3.1 Enhanced Mode compatibility, permitting complete *Windows* application support. Included was an expanded set of device drivers and Multimedia Presentation Manager/2 (MMPM/2).

The operating system included a Productivity folder in the OS/2 System object that contained PM Terminal for communications; Fax/PM for fax communication; a system file and icon editor; audio recording and editor; audio CD player; simple spreadsheet, chart making, database, daily planner, file-search and view applications; and a few games. The WIN-OS/2 module also includes the familiar *Windows* Accessories Group. Version 2.1 required, at best, an 8M 486 PC and 35M to 45M of hard-drive space, depending on what components were installed.

IBM offered OS/2 2.1 for *Windows* (OS2FW) in November 1993, aimed at the vast *Windows*-user base. OS2FW installed over a PC's existing *Windows* 3.1 setup and made it a part of a new full-featured OS/2 operating system with all the familiar *Windows* screens and setup intact. It also addressed the increasing demand for reliable higher-resolution device drivers for the new graphics-accelerator cards.

OS2FW added a lite version of *FaxWorks for OS/2* to the applet pack. The result was a product that was functionally equivalent to OS/2 2.1, using the existing investment in *Windows* applications while expanding a previously under-powered and unstable *Windows* 3.1 operating environment into the powerful, reliable, high-performance 32-bit OS/2 operating system.

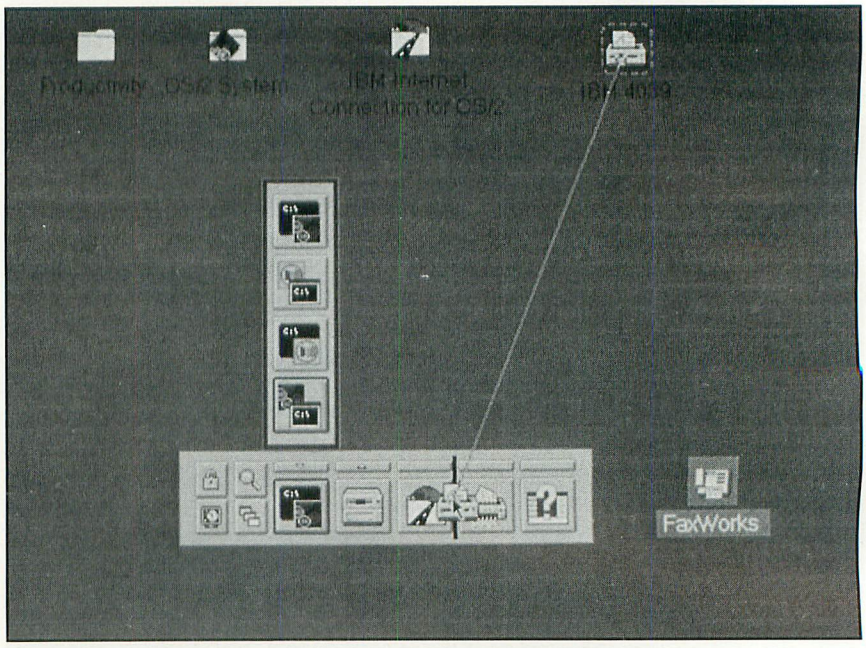
Enter *Warp*

Released in October 1994, OS/2 *Warp* finally takes full advantage of the 32-bit-processing architecture of the Intel-based 386, 486 and Pentium CPUs that DOS and *Windows* can't provide. It features the object-oriented GUI, the WorkPlace Shell Desktop, that permits seamless simultaneous running of DOS, *Windows* and OS/2 applications. The October release of OS/2 *Warp* ($129) required DOS and *Windows* 3.1 to be previously installed on a PC. The March 1995 release of OS/2 *Warp* with WIN-OS/2 Full Version ($199 list) permits installation of OS/2 on PCs that don't have DOS or *Windows* already installed. If you don't have OS/2 2.0 or 2.1 installed, IBM offers OS/2 *Warp* without WIN-OS/2 for $89 and OS/2 *Warp* with WIN-OS/2 Full Version for $129.

IBM color-coded the packaging of the different versions to help avoid confusion between the two products. The red-labeled package is the version of OS/2 *Warp* that doesn't have WIN-OS/2 for users who already have DOS and *Windows* 3.1 on their PCs. A blue-labeled package is for users who want to install OS/2 *Warp* with WIN-OS/2 Full Version on their DOS-only PCs.

A network-intensive version, OS/2 *Warp Connect* ($299), became available for PC networks during the fall of 1995, permitting connection to the Internet (TCP/IP), *Windows NT*, Unix, *NetWare*, *Windows for Workgroups* and IBM servers for sharing disk drives, printers, graphics files, databases and other applications. IBM added *Lotus Notes Express* to the *BonusPak* included with OS/2 *Warp Connect*.

As a result of the lessons learned throughout OS/2's history, *Warp* features a smaller (4M) RAM "footprint," an improved configuration architecture (it can recover gracefully from corrupted configuration data) and greatly expanded device-driver support for faster and easier system setup and installation.



The *Warp* LaunchPad screen.

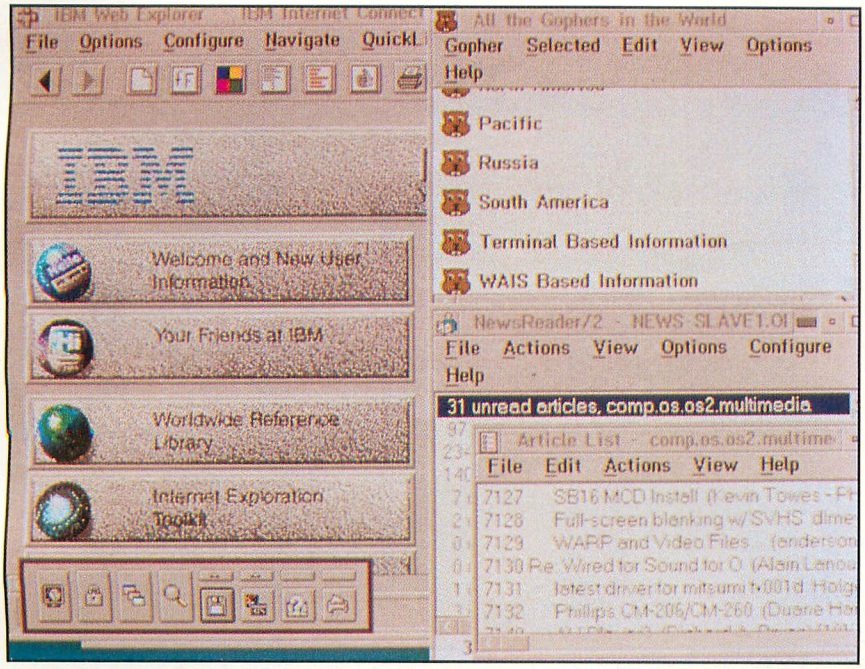
During the initial boot-up phase of installation, the OS automatically determines the video, disk and peripheral configurations and properly identifies hardware devices. The installation environment itself shows up as a "Maintenance Desktop" Workplace Shell object. An Easy Install option, designed for newcomers, results with *Warp* making most of the decisions about hardware and software configuration, based on the results of its automatic hardware-detection phase.

The Workplace Shell has been improved with better animation, more-logical menu layouts and a quick-access "LaunchPad" for frequently-used applications. *Warp*'s Workplace Shell has a true object-oriented interface. It uses the System Object Model (SOM) based on the open industry standards approved by the Object Management Group (OMG) that provides complete object tracking. Simple operations like dragging a directory to another directory won't invalidate links and other interface structures.

Using the IBM *Works* applet from the *BonusPak* offers a good example of the advantages of SOM technology. To fax a letter, you drag the business card from the address book and drop it on top of a document. Then you drag the document to the fax-machine icon. *FaxWorks* retrieves the fax number from the business card and faxes the document in the background.

The three applications—word processor, address book and *FaxWorks* (all included in the *BonusPak*) written by three different independent software vendors—provide complete integration because they all inherited their drag-and-drop capability from the Workplace Shell SOM object based on open standards and are OMG-compliant. This differs from *Windows* OLE 2.0, which isn't based on the OMG open standard.

The $159 blue-label OS/2 *Warp* 3.0 mail-order package delivers the full version of OS/2 *Warp* with WIN-OS/2 and includes a working copy of DOS and *Windows* 3.1, an efficient memory manager and support for many VGA and super-VGA display adapters, SCSI, IDE and EIDE controllers, audio cards, Adobe and TrueType fonts and more than 300 Epson-compatible dot-matrix, Hewlett Packard-compatible ink-jet and laser printers. If you already have DOS 5.0 or later installed on your PC, an upgrade version is available for a mail-order price of $125. If you have both DOS and *Windows* 3.1 installed, you can get OS/2 *Warp* without WIN-OS/2 (red



Warp with the Internet connection.

label), which delivers all the OS/2 features and keeps your current *Windows* setup, for about $75.

This new productivity comes with a price both in terms of money that goes beyond the initial cost of the software and in time you'll spend installing and learning the new operating system.

What You Need

Before you buy OS/2 *Warp*, inventory your PC's hardware. OS/2 requires hardware that enables it to bring your PC into the future. Your old IBM PC/, XT/ or AT/compatible is useless for a *Warp* setup. Unless you're now operating DOS and/or *Windows* on an enhanced 486 PC, you need to add significantly to the cost of your *Warp* purchase, which can include upgrading your present PC or even replacing it, depending on the applications you plan to use.

IBM suggests that a basic *Warp* system include, at the very least, a 386SX PC with 4M of RAM, 200M hard drive and 14" VGA video monitor with 0.28-mm dot pitch. Such a setup is available for less than $600 from most mail-order houses. However, *Warp* is more efficient and runs better on a 486 or Pentium PC with 8M of RAM. If you plan to multitask more than two major applications, install upwards of 16M of RAM and even make sure that your PC's motherboard can accommodate up to as much as 128M of RAM for future expansion.

• ***Adding RAM.*** 486 and Pentium motherboards usually have two banks of one, two or four sockets for SIMM RAM. The SIMM has three, eight or nine memory chips soldered onto small card-like modules. It's essential that all SIMMs be of the same speed —usually 70 ns.

Basically two forms of SIMM upgrades are available: 30- and 72-pin. Thirty-pin SIMMs come in 1M modules (1M X 3, 1M X 8 or 1M X 9) or 4M modules (4M X 8 or 4M X 9) that usually must be installed with four modules in a bank on the motherboard. Newer motherboards that have greater RAM upgrades to 128M use 72-pin SIMMs in 2M (512K X 36 or 512K X 32), 4M (1M X 36 or 1M X 32), 8M (2M X 36 or 2M X 32) and 16M (4M X 36 or 4M X 32) and even 32M (8M X 36 or 8M X 32) modules. The "X 8" and "X 32" indicate that a SIMM is for non-parity motherboard, and "X 3," "X 9" and "X 36" indicate a SIMM with parity memory chips that include an extra bit per byte the system uses to check for memory errors. A check of the motherboard's manual will tell you if it requires parity or non-parity SIMMs.

You usually install SIMMs with two or four in a bank to attain the desired RAM configuration. It's very important that you have identical SIMMs in each bank. Also, you must fill Bank 0 first. Carefully check your motherboard manual for exact setup, type and number of SIMMs needed to upgrade your system to obtain the desired RAM and then reset the motherboard's CMOS setup. Figure to spend $30 to $45 per megabyte for the RAM SIMM upgrade from such retailers as Memory Express (tel.: 800-877-8188) and First Source International (tel.: 800-683-9866).

• ***Storage Needs.*** You should have at least 60M of available hard-drive space for a full-featured OS/2 *Warp* installation with its multimedia, WIN-OS/2 support and the *BonusPak.* A minimal installation of *Warp* without multimedia, the *BonusPak*, help and sampler files needs about 30M. If you choose full multimedia support and sample files, add 10M to 15M to this figure.

Keep in mind that once you're comfortable with OS/2, you'll be able to free about 20M to 25M of space by deleting your old *Windows* and DOS directories (only if you're installing the OS/2 *Warp* with WIN-OS/2 package) and any memory managers you may now have on your PC. As a comparison of 32-bit operating systems, *Windows NT* and *Windows 95* each require 80M+ of hard-drive space for full installation and at least 16M of RAM to operate smoothly.

I've found *Warp* to have very reliable PCMCIA peripheral and Advanced Power Management (APM) BIOS support for laptop PCs. I set up my ThinkPad 340 with a 125M hard drive and 8M of RAM with the minimum configuration for a *Warp* laptop installation. I installed *Warp* with WIN-OS/2 support and the *FaxWorks* and *CIM for OS/2* communication programs from the *BonusPak.* Not installing any of the tools and games (2M); multimedia support (2M); the HPFS system (0.3M), the serviceability and diagnostic aids and background bitmaps (1.5M) and the REXX support, tutorial and help files (2.5M) saved more than 9M of space. While there wasn't much drive space left for other programs after installing my word processor, all I wanted was a streamlined mobile system for portable use.

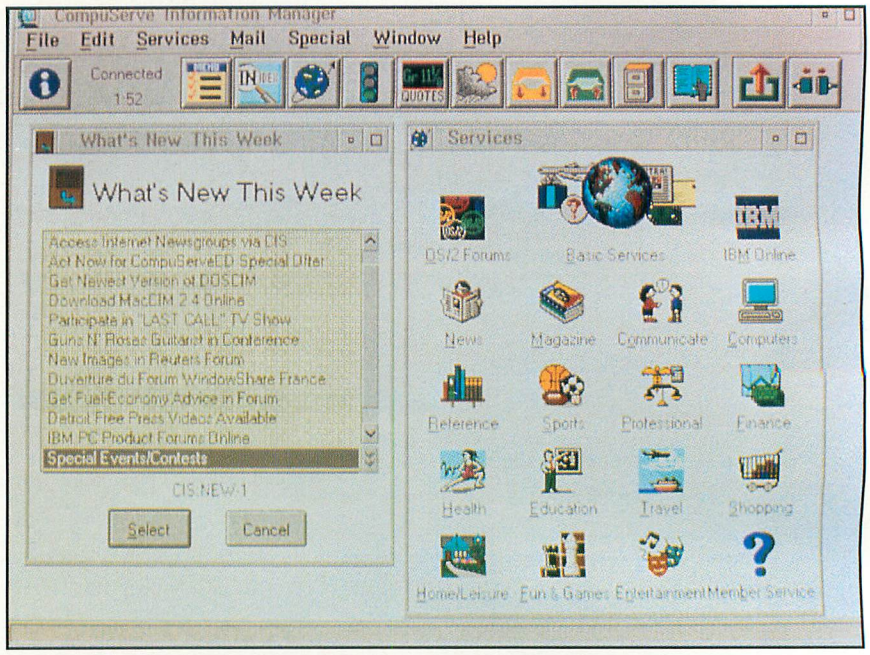
Warp can be successfully installed on all IBM ThinkPads; Ambra 486 SN425C; AST Ascentia, Bravo and PowerExec; Austin DSTN; Compaq Concerto; CompuAdd 425TX; DELL; *Matsushita*; NCR Safari; NEC Versa; Panasonic; Toshiba T3600, T4500, T4600 and T4700 and T4800; Zeos; Zenith Z-lite laptop microcomputers. Also supported is a Socket Service device driver for the PCMCIA (PC Card) chipsets from Cirrus Logic, Databook, IBM, Intel, Ricoh and Toshiba.

When upgrading a PC's operating system to *Warp*, give consideration to what OS/2, DOS and *Windows* applications you'll be running. A word processor like *Describe* 5.0 for OS/2 ($49 CD-ROM single-user version) or Lotus *Ami Pro for OS/2* ($295) consumes 25M to 40M for just the program and some font files. Desktop-publishing software like Aldus *PageMaker* ($895) and Corel *Ventura 5 Publisher* ($495) each takes up another 25M to 35M. An extensive draw/paint and illustration program like *CorelDRAW! OS/2* ($199) or *CorelDRAW!* 5 ($495) need 80M to 100M of space for its program and clipart files. When Corel releases an OS/2 version of *CorelDRAW!* 6.0 ($795), more than 130M will be needed. A spreadsheet program like Microsoft *Excel* ($495) or Lotus *1-2-3 for OS/2* ($495) requires 30M to 40M for the program, charts and clipart files.

Lotus Development (recently purchased by IBM) also offers a *SmartSuite for OS/2* ($695) that takes up more than 90M and includes word-processing (*Ami Pro* 3.0), spreadsheet (Lotus *1-2-3*), presentation graphics (*Freelance*) and interoffice communications (cc:Mail) applications. If you plan on using any of these, factor in the cost of a fast IDE or EIDE hard drive with a capacity of 840M or 1G ($200 to $250). If you might go beyond 1G, install a SCSI hard drive, which can go to many gigabytes of storage for $350 to $1,200. You can link up to seven drives SCSI drives from one controller card that costs $100 to $250.

Warp also directly supports such SCSI removable storage media as Bernoulli and SyQuest 44M, 89M, 105M and 250M data tape drives.

• ***Clear Viewing.*** Selection of an appropriate graphics card is an essential factor in installing OS/2 *Warp*. Today's PC hardware displays four levels of color resolution, including: basic VGA four-bit/16-color at resolutions up to 640 X 480 pixels; super VGA (SVGA) eight-bit/256-color at up to 800 X 600 resolution; HiColor 16-bit/32,800 colors at up to 800 X 600 and TrueColor 24-bit/16.7-million color at up to 1,024 X 768 resolution. *Warp* offers a seamless 32-bit graphic engine with display drivers for all standard four-bit VGA 16-color and 256-color eight-bit super-VGA display adapters.



Warp during a CompuServe session.

Warp comes with a variety of SVGA Presentation Manager and WIN-OS/2 drivers. SVGA drivers are included for the popular industry chipsets from ATI, Cirrus Logic, Headland, Trident, Tseng, Weitek and Western Digital. It specifically supports ATI 28800, AX-Mach 32, GX-Mach 64; Cirrus Logic CL-GD5422 and 5424; Headland Technologies HT209; IBM VGA256C, XGA, 8514/A; Sierra Semiconductor Hi-Color (S3) RAM DAC accelerator 86C801, 805, 864, 928; Trident Microsystems TVGA8900, 8900B, 8900C; Tseng Labs W32, W32i, W32p, ET4000; Weitek P9000, P9100; and Western Digital WDC24, WDC231, WDC33, WD90C11, 90C30, 90C31, 90C33 chipsets. It also supports PCI versions of these graphics cards to take advantage of the faster data-transfer speeds available on Pentium motherboards.

SVGA display adapters from other manufacturers need OS/2 drivers to obtain SVGA support. These are usually available for downloading from the manufacturer's BBS or CompuServe if the vendor maintains a User's Forum. Driver software downloads from the on-line service are compressed program files that either self-extract or need PKWare's *PKzip* Version 2.04g to unzip the downloaded files into the installation files.

Installation of third-party manufacturer drivers can be a bit tricky. Consequently, sticking with the fully supported manufacturers and chipsets is strongly advised. Keep in mind that most of the popular *Windows* graphics and multimedia applications now require a minimum display of 256 colors at 640 X 480 SVGA resolution.

Working with images in SVGA resolution requires at least an ISA High Color accelerator card like the Diamond 2M VRAM Stealth Pro ($165) that contains an S3 accelerator chipset to produce 16.7M colors and significantly speed up the monitor screen's refresh rate. After installing the OS/2 S3 drivers provided in *Warp* or updated by the Diamond BBS (tel.: 408 325-7080), you can easily select the resolution required by an application.

If your motherboard has a VESA Local Bus (VLB), an accelerator card

Table 1. MPC1, MPC2 & MPC3 Minimum Standards

	MPC1	MPC2	MPC3
System	386SX/16 MHz	486SX/25 MHz	Pentium
RAM/Storage (M)	4/80	4/160	8/540
CD-ROM Speed	Single	Double	Quad
Audio Card	Eight-Bit	16-Bit	16-Bit, Wavetable
Video Card	640 X 480 256 Colors	640 X 480 64K Colors	640 X 480 64K Colors; MPEG1

like Diamond's VLB Stealth 64 with 2M/4M of VRAM ($299/$349) speeds up graphics images by 40%. Best results are available with a Pentium motherboard that has PCI slots. You can take advantage of the 32-bit high-speed PCI-bus data-transfer rate with accelerator cards like Diamond's Viper Pro with 4M of VRAM ($449) or Edge 3D with 4M of VRAM ($450); Number Nine's 9FX Motion 771 with 4M of VRAM ($499) and Imagine 128 with 4M of VRAM ($795)—the last is reportedly the fastest accelerator card currently on market and is powered by the latest generation of the S3 technology, the Vision 968 accelerator chip.

You need a faster-speed accelerator card to effectively display the current state-of-the-art graphics and multimedia programs. While many CD-ROM titles contain only 160 X 120 resolution, at best 320 X 240, and 15 fps clips, most of the newer .AVI clips play at 320 X 240, 24-bit video at a full 30 fps. These next-generation cards scale video up to 640 X 480 or more and perform pixel-smoothing interpolations that improve video quality.

The OS/2 WorkPlace Shell Desktop can put up a lot of information on-screen. Multitasking applications result in many windows displayed on the Desktop working at the same time that you must read. They'd minimally display at a resolution of 16 colors at 640 X 480 and require a 15" monitor like the Philips 1520 Brilliance ($499) that supports a 72-Hz refresh rate to achieve flicker-free eye comfort. A bonus with this monitor is a built-in stereo amplifier with speakers, headphone jack and volume control for multimedia use.

It would be easier to view these multitasking applications on the larger display area of a 17" monitor like the Philips 17" Brilliance ($799) with a 76-Hz refresh rate or Nanao Flexscan T2-17TS ($899) that offers a 55-to-160-Hz refresh rate. This refresh rate more than meets the new VESA refresh rate standard of 75 Hz, resulting in flicker-free eye comfort.

• ***Multimedia Support.*** Full multimedia support is built into *Warp* with IBM's Multimedia Presentation Manager/2 (MMPM/2), offering extensive multimedia features as part of the base operating system. It has been enhanced to play digital motion video in software at 30 fps, with no video-output hardware required.

Built-in is support for Kodak PhotoCD; MPEG motion clips; Compressed Audio (ADPCM) playback; playback of Autodesk *Animator* .FLI and .FLC files; a revised Direct Interface Video Extension (DIVE) API for direct video hardware access; and an extensive list of audio and video-capture device drivers. MMPM/2 provides system sounds on the Desktop (similar to *Windows* 3.1), an audio recording and editing applet and an easy-to-use applet for playing CD-ROMs.

MMPM/2 provides a full set of multimedia programming interfaces to use OS/2 Ultimedia and *Windows* MPC applications. IBM and some multimedia vendors have developed the OS/2 Ultimedia Tools Series (UTS) logo to indicate compliance of hardware and software with the OS/2 MMPM/2 setup. UTS is an effort to establish standards that make it easier for you to use multimedia tools. They support the operating system platforms that people are using—DOS, *Windows* and OS/2.

Minimum specifications for Ultimedia compliance include a 20-MHz 386SLC CPU with 4M of RAM, CD-ROM XA drive, 160M hard disk, SVGA display, CD-audio subsystem and microphone running under OS/2 2.1 or later, with MMPM/2 support for DOS and *Windows* 3.1 MPC applications.

The *Windows* Multimedia PC Marketing Council (MPC) has established hardware and software standards for the *Windows* multimedia market: MPC1, MPC2 and the new MPC3 (Table 1). If you plan to use multimedia, look for either the OS/2 Ultimedia Tools Series or MPC logo on hardware and software to confirm compliance with these standards. The MPC Marketing Council moved responsibility for MPC Level 3 to the Software Publishers Association's Multimedia PC Working Group, which includes many of the same members. For information, contact the SPA at 202-452-1600 or mpcinfo@spa.org on the Internet.

MMPM/2 supports MIDI, .WAV and CD/XA sound file formats and includes device drivers for MediaVision Pro Audio Spectrum 16 ($195), Pro Audio Studio 16 ($245) and Jazz 16; Creative Labs SoundBlaster family ($99 to 250); Aztech Labs Nova 16 cards; Advanced Gravis Ultrasound; Microsoft Sound System; and IBM M-Audio ($495).

Additionally, *Warp* has SCSI-2 drivers for such cards as the Pro Audio Studio and SoundBlaster 16-SCSI that also include SCSI-2 connections for a CD-ROM drive. Factor in another $25 to $75 for amplified external speakers to connect to the sound card. I can't stress enough that you stay with the vendors mentioned here for easy installation of OS/2. Using third-party sound cards and drivers is an invitation to frustration.

Warp has extensive support for multimedia video users, with drivers for PC Video-based cards like the Creative Labs VideoBlaster ($495), Jovian QuickVia, IBM Video Capture Adapter/A ($1,200), Sigma Designs WinMovie and WinMovie/2, New Media Graphics Super Video Windows and Samsung's Video Magic through the *Video IN for OS/2* included in *Warp*'s *BonusPak*. Sigma Designs ReelMagic card ($695) and Hauppauge's Win/TV family of cards ($495 to $695) are also supported.

• ***Interruption Sensitivity.*** Due to OS/2's ability to multitask and multithread applications, it's very sensitive to port (LPT1, LPT2, COM1 through COM4) and interrupt (IRQ) assignments. When I was installing the SoundBlaster 16 with a factory default setting of IRQ7, it worked fine under DOS and *Windows*. After in-

(Continued on page 104)



By Ted Needleman

Microcomputer Musings

Hardware and Software—and Something That's Neither

This time around, I have an interesting assortment of goodies to look at—mostly software, but with a nice piece of hardware for spice.

Neither Fish Nor Fowl

First out of the gate is a set of products that don't quite fit into either category. As a heavy user of graphics software, and with four kids, each with his or her own PC, I've got a number of color printers in my house. I alternate between a Hewlett Packard LaserJet 4 for monochrome work and a Fargo Primera wax-transfer printer for most of my color printing. The kids, however, all have inkjets. There's a nice mix of vendors. Bryan has an HP and Karin and Scott have Canons. Marc has an Epson Stylus Color. All of them burn through inkjet cartridges at a hefty rate. When you add in my HP Fax 900, which uses the same cartridges as a DeskJet, you can imagine my yearly inkjet cartridge costs.

It will probably come as little or no surprise that I try to refill cartridges whenever possible. If you visit any office-supply superstore, you'll find a variety of refill kits hanging on the wall displays. I've been playing with a couple of different vendors' products lately, and I have to admit with being impressed with both of them.

Repeat-O-Type is a company with which I've had positive experiences in the past. It was one of the first companies to enter the inkjet refill market, and I tested (and loved) its first product, a specially modified HP DeskJet 500C cartridge and refill inks, several years ago.

In the intervening years, the company has substantially broadened its product line, adding refill kits for other printers, such as the Epson Color Stylus. The line of Canon BJC-4000 refills I recently tested doesn't require a specially modified cartridge. This printer, and the new BJC-4100 use a print cartridge that can be refilled simply by depositing ink on a felt pad that's part of the cartridge.

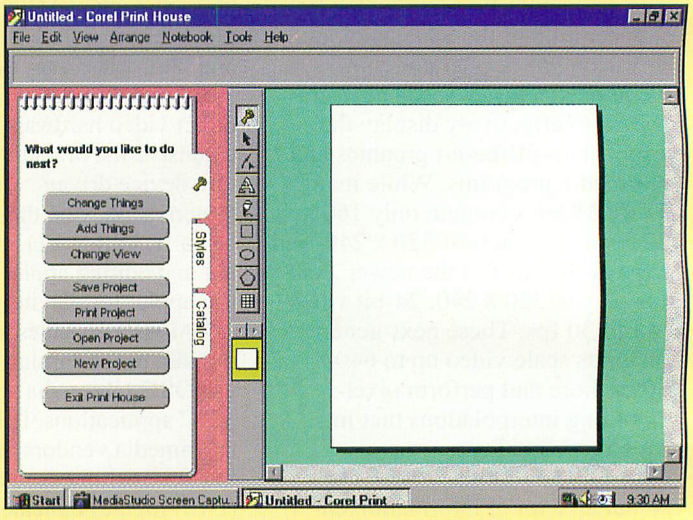
The BJC-4000 actually can use one of a number of cartridges. In strictly monochrome mode, it uses a BC-20 printhead, which contains a large black-ink reservoir. The Repeat-O-Type BC-20RBK, with a suggested list price of $14.50, refills this cartridge once. Since Canon's own printhead/cartridge carries a suggested price close to $30, this can represent a substantial savings.

Similar savings are possible with refills for the color cartridge. The BC-21 printhead has a black-ink cartridge (with substantially smaller capacity than the BC-20) and a tricolor cartridge with cyan, magenta and yellow inks. Each $14 (suggested retail price) refill cartridge can refill one color four times. With Canon's tricolor insert costing $21 (srp), it won't take long to see big savings—especially if you go through color pages the way my kids do.

Using the refill kit couldn't be simpler. The kit is basically an eyedropper. Just drip ink onto the pad on the cartridge. The most difficult part is trying to squeeze no more ink onto the felt pad than the cartridge can absorb. The instructions warn you to wait until the printer's ink-low light comes on. Otherwise, it's possible to overfill the cartridge and create a mess. If you take your time, you can't go wrong with any of Repeat-O-Type's inkjet refill products.

Sercomp's Neat-Jet is a bit more difficult to use, but not by much. The well-illustrated instructions take you through the process of attaching the refill adapter to a used cartridge, draining the ink pouch into the cartridge and priming the cartridge for reuse. The box even forms a little stand to minimize any mess should you spill some ink. The whole process takes just a few minutes, and Sercomp's instructions state that a typical HP 51626A high-capacity cartridge can be refilled three times. There's even a toll-free telephone number to call if you run into problems.

Sercomp sent me both black and blue refills, and the company will be bringing out a kit for the HP tricolor cartridge and for a variety of other vendors' inkjet printers. With a new HP 51626A cartridge selling for about $30, the $10 cost of a refill is very attractive. If you're using an HP DeskJet printer, you



Start screen for Corel's *Print House* draw program.

may want to give Sercomp a call for its data sheet and a referral to a local dealer.

Corel Takes Off

Everyone knows Corel. It's main product, *CorelDRAW!* 6, is the market leader when it comes to draw software. I've been using *CorelDRAW!* 6 for a number of months, but I've hesitated to review it. Not that it's not worthy of a review—with all of the functionality built into the product, there's little that a skilled user couldn't accomplish. But the operative phrase here is "skilled user." Most of my graphics attempts are rudimentary. I use *PhotoPaint* 6 for image retouching, but most of my "drawing" consists of pasting down one or more pieces of clipart—hardly impressive *bona fides* for reviewing *CorelDRAW!* 6.

Over the past couple of months, though, Corel has sent me a number of products that I do feel comfortable talking about. The first of these, the Corel *Stock Photo Library 2*, is an extension of the Corel Photo Collection Disc I reviewed last year. Corel produces a large number of these discs, each containing 100 high-resolution digital photos that deal with a particular theme, and offers them individually for about $20 each or in various combinations and collections.

Each of the two available photo libraries contains 200 CD-ROMs containing 20,000 different photos. You can use these photos pretty much any way you like, as long as you don't resell them. Each library also comes with browser software (Corel *Mosiac*) and various handy utilities. The *Library* also comes with a book that shows thumbnails of all 20,000 of the photos.

I'm not going to go into detail about what categories are included in the different collections because there are just too many of them to list and you can obtain a catalog that details all of the available discs and collections. What I will tell you, though, is that the street price of about $700 is a real bargain if you use stock photography for newsletters, brochures or the like. If you use just a few of the 20,000 photos, you've already paid for the collection.

While the photo discs may not be of particular interest to some of you, Corel's latest graphic product, *Corel Print House*, probably will be. The one graphics market segment that Corel doesn't dominate is the low end. To this point, Corel's least-expensive graphic program (other than *CorelFLOW*, which really isn't a draw package), has been *CorelDRAW!* 3.

Several years old already, it still sells for more than $100, and very well at this price. But at the less-than-$50 price point,



PrintPaks Calendar Kit is a kid-oriented calendar-design software package from PrintPaks, Inc.

Borderland's *Print Shop* and Micrografx's *Windows DRAW!* 3 (recently superseded by *DRAW!* 4) have a really commanding presence in the market.

Print House is meant to change this. With an "introductory" price of $29.95 and running only under *Windows 95*, it contains a somewhat stripped-down version of the new *CorelDRAW!* 6 draw engine and lots of extra goodies on a single CD-ROM.

Corel claims that the base of the product is a *CorelDRAW!* 6 "mini-engine," but the greatest difference between *Print House* and the other Corel *DRAW!* products is the interface. When you start up *Print House*, you're presented with a selection of "projects" you can complete. These include letterheads, signs, cards, calendars and a host of others. Yes, you can use the product to just draw, but in an effort to make the software easy to use, this isn't the initial choice.

This approach sounds a bit simplistic, but it actually works very well. Most graphics software users have a particular goal in mind, and the template-oriented method is an easy way to jump-start the effort.

In addition to the large variety of wizard-assisted templates, there are lots of graphics elements to make your efforts look good. Corel has built up a huge catalog of really nice clipart over the years and includes 5,000 pieces of it with *Print House*. Most of this clipart is in color and is editable.

If all of this clipart isn't enough to make your graphics projects look good, add 1,000 photos, more than 200 backgrounds and 70 page borders. Finally, there are 1,000 phrases for your cards and flyers (some are better than others) and more than 100 TrueType fonts. In fact, the huge manual that accompanies this product is mostly a catalog of all of the graphic elements.

Instructions for using the software are just a minor part of the documentation. This is fine, as the software isn't very difficult to figure out, and there's lots of online help available if you run into a snag. In fact, my only criticism is that you must have the CD-ROM in your drive when using the software. It's not really a copy-protection scheme because you can install the software on a number of systems. But it does ensure that the software will be run by only one user at a time and that the vast collection of clipart and other graphic elements will be instantly available to the software as you use the program.

I've seen *Print House* priced at the $29.95 "introductory" price in a number of major mail-order catalogs, but I don't know how limited this price will actually be. Corel states that the price will rise to $99 after the "introduction" period ends. Even at $99, *Print House* would be a good deal. At less than 30 bucks, it's a steal. If you do anything that requires graphics, or just like to play around, be sure to pick up a copy of *Print House*. Even your kids will have fun with it.

Put Tab A Into Slot B...

While I'm on the subject of graphics and

kids, I picked up a neat package when I was at Comdex last November. It's called *PrintPaks Calendar Kit*, and it's one of a series of kid-oriented craft packages from a new company called PrintPaks, Inc. The company feels that there's an emerging market of home-based PCs equipped with color inkjet printers and, thus, is bringing out a line of inexpensive packages that let kids use the PC and color printer to create interesting and useful projects.

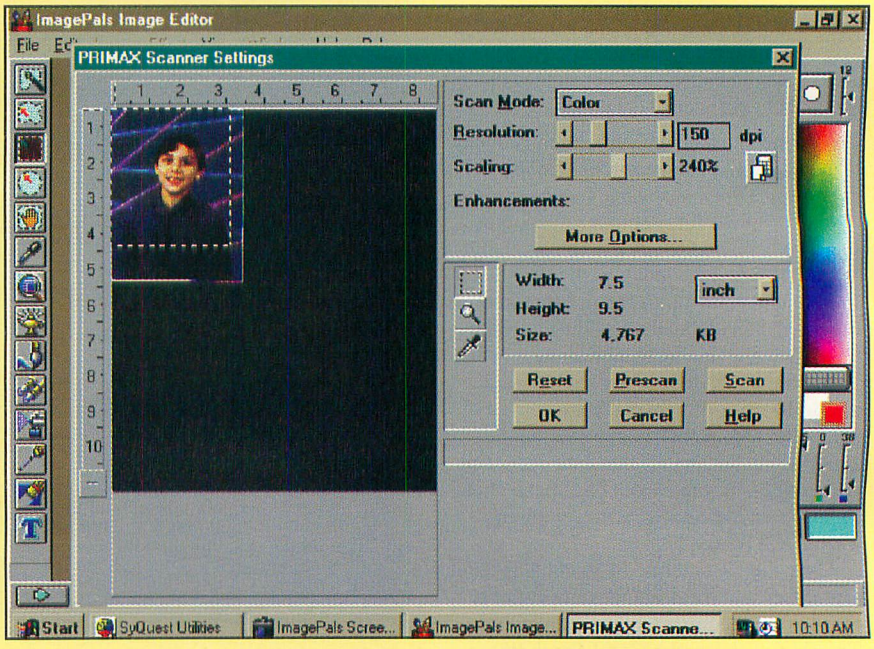
The company's first two projects are a *Holiday Ornaments Kit*, which my kids enjoyed but came out too late to be reviewed in a useful time frame, and the *Calendar Kit* reviewed here. Both products are available in many superstores or directly from PrintPaks. *Calendar Kit* is available only on CD-ROM, costs less than $25 and features inexpensive refills.

After you've installed the program, an animated dog named Max guides your kids through the process of creating a custom calendar. For each month, you can select from a gallery of clipart images supplied on the CD-ROM, your own graphics collection or even from Photo CD photographs.

There's even a mailer in the box so that you can send away negatives and slides to be put on a Photo CD, though if your kids are anything like mine, there's no way they'll wait until the Photo CD comes back. After each month's graphic selection is made, you can add a line of your own text to the bottom of the calendar page. A cute touch is that the cursor is in the shape of a dog bone (remember, your on-line guide, Max, is a pooch).

When your child is done and is ready to print, he or she is asked if the system's default printer is one of the ones the program requires. Here is where the software comes up short. The PrintPak series are *Windows* packages and, as such, should probably support any color printer that *Windows* does. After all, this is one of the major advantages for using *Windows*. PrintPaks supports the HP 600 and 800 series of DeskJets, Canon BJC-4000 and 600 and the Epson Color Stylus. That's it. If you have another vendor's printer, you won't be able to select it.

In the real world, this probably isn't as major a problem as I'm making it out to be. A lot of potential purchasers will have one of the above-mentioned printers. Even if you don't, the software will work on many others, like Lexmark's great new WinWriter 150c and 1020, which use HP's PCL-3 language as the standard. Even the Lexmark OptraC color laser printer I'm testing in my office did a pretty decent job of turning out calendar pages, though it did take several tries to obtain the single sheet page positioning right.



Scanner Settings screen for Primax Deskscan flatbed color scanner.

Each kit comes with specially punched and sized paper for two calendars, along with a spiral plastic piece to bind together the pages. Refill sets can be ordered over the telephone at a cost of $9.95 and are delivered by two-day mail.

My kids are having a lot of fun with the PrintPaks kits, and if your kids aren't yet teenagers, chances are they will, too. I'm looking forward to PrintPaks' next products.

Every Picture Tells a Story

The final product I have to report on in this issue is hardware. When I reviewed Primax Electronics' picture-sized motorized Office Mobil scanner last year, I didn't know that it was just the first in a series of scanner products the company was planning to release. At that time, I liked it a lot, but I felt there were some things a full-sized scanner might be more appropriate for, such as document management and OCR. If the cliché "All things come to those who wait" is true, Primax's new Deskscan color scanner must be the proof.

Deskscan is a small-footprint 24-bit color flatbed scanner. It can accommodate up to 8½" X 14" (legal) size paper and comes with a jumper-less SCSI interface card and software. The unit itself and interface card seem to be made by Microtec, a popular scanner provider, as Microtec's name is prominently mentioned numerous times in the scanner's documentation.

The software Primax provides is from a number of vendors. The drivers are probably from the hardware vendor and include the popular TWAIN drivers that are accessible from most *Windows* packages, as well as direct DOS-level drivers that are recommended for use with some non-*Windows* packages.

Ancillary software includes *Finishing Touch*, essentially the same as U-Lead Software's terrific *ImagePals Editor*; Storm Software's *PhotoMax* software, which allows you to keep track of your images; and *TextBridge* Version 3.0, Xerox Software's popular OCR package.

Installing the unit takes just a few minutes. The jumper-less SCSI interface card is easy to set up. I also restored my system to its previous state and tried daisychaining the scanner to the SCSI port on the Syquest EZ*DRIVE 135 135M drive I'm testing. The documentation doesn't mention anything about doing this, and I had to scare up a different cable with a large Amphenol connector on both ends, but the software installed fine, and most of my applications worked okay with it.

I did have trouble scanning from Corel's *PhotoPaint* 6 and Micrografx's *Picture Publisher* 6. But I have a feeling that this is the fault of the applications—not the scanner driver—as I've also experienced some printing problems with these applications. *Picture Publisher* 5 worked okay, as did *ImagePals* 2.0 and the *Finishing Touch* and *Text Bridge* software supplied with the scanner.

The scanner itself is touted as having up to 1,200-dpi resolution. In doing so, Primax is following a practice promulgated

Products Mentioned

Canon BJC-4000 Ink Refill, $14.50 (BC-20 cartridge refill) or $14 (BC-21 cartridge refills, each color). Prices are suggested retail.
Repeat-O-Type Manufacturing Corp.
665 State Hwy. 23
Wayne, NJ 07470-6892
Tel.: 201-696-3330
CIRCLE NO. 46 ON FREE INFORMATION CARD

Neat-Jet HP 51626A refill, $11 (srp), $9.95 expected street price
Sercomp Corp.
21050 Lassen St.
PO Box 4119
Chatsworth, CA 91313-4119
Tel.: 818-341-1680
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Stock Photo Library 2, $1,000 (srp), $700 (street); *Print House*, $29.95 (introductory offer)
Corel Corp.
The Corel Bldg.
1600 Carling Ave.
Ottawa, Ontario, Canada K1Z 8R7
Tel.: 800-772-6735
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PrintPaks Calendar Kit, $25
PrintPaks, Inc.
834 SW St. Clair Ave.
Portland, OR 97205
Tel.: 800-774-6860
CIRCLE NO. 49 ON FREE INFORMATION CARD

Deskscan Flatbed Scanner, $399
Primax Electronics
521 Almanor Ave.
Sunnyvale, CA 94086
Tel.: 800-338-3693
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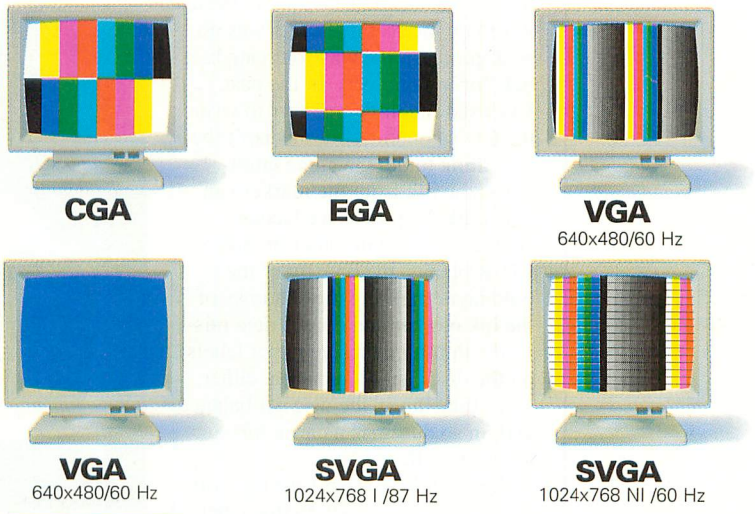
by other scanner vendors. Yes, you probably can get around 1,200-dpi resolution scans, depending on what you're actually scanning. But this is extrapolated resolution. True optical resolution of the scanner is 300 x 600 dpi.

Before you blow off the scanner with a "that's not much" comment, be aware of two scanner facts. The first is that unless you're scanning slides or transparencies (which requires an adapter Primax doesn't offer), you rarely scan anything at much more than half the resolution of the intended output device. For most users who have a color inkjet or laser printer, this will be between 150 and 300 dpi. Second, pixel depth is usually more important than actual scan resolution.

Deskscan offers 24-bit color or 256 shades of gray, which works really well in most cases. The scanner driver offers a good automatic setting, and you can override most of the settings for tweaking the scan when needed.

The real news on Deskscan is its price —$399. This includes the interface card and software, in addition to the scanner. Yes, you can easily spend a lot more on a flatbed scanner, and you may have to if you need a transparency adapter or automatic document feeder. But for most simple graphics uses and OCR, the Primax unit will work just fine. And it's a real bargain at the price. ■

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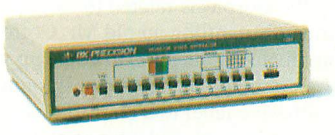


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CIRCLE NO. 56 ON FREE INFORMATION CARD



By Tom Benford

A Nifty Device for Printing and Applying Labels to Home-Made CD-ROMs, Some New-Style Disks and Goodies for Band-in-a-Box Users

As you can see from the title of this column, I cover a bit of ground this time out. I'll lead off with something that really intrigues me.

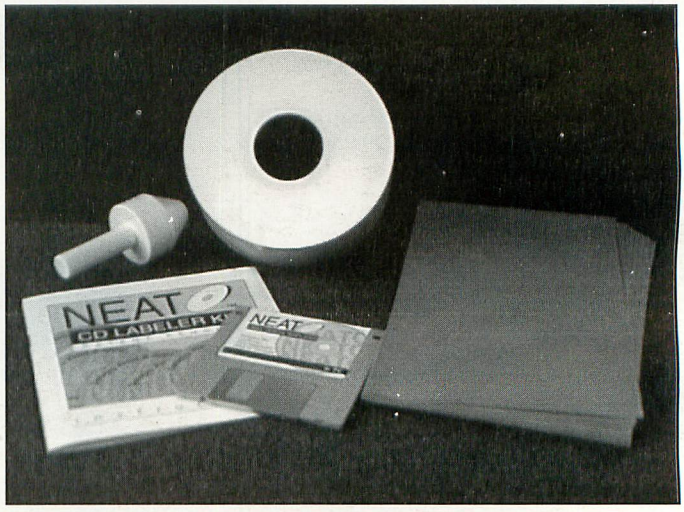
Neato CD Labeler Kit

I've been "burning" my own CD-ROMs for a couple of years now, and I've always been vexed by the fact that there was no neat, professional way to create labels for my one-offs. In the past, I've used indelible markers to write the CD's contents, but this isn't the best thing to do. On some emulsions, the ink from the marker can penetrate the protective lacquer coating, while with other brands of CD-R blanks, the opacity of the gold layer picks up the shadows of the ink marker and causes data misreads. Putting adhesive paper labels on the discs isn't a panacea, either, since they throw the disc off balance and, in so doing, can cause misreads as well.

Apparently, I wasn't the only one who sought a solution to this labeling dilemma because MicroPatent has released a Neato CD Labeler Kit, which gives you everything you need to design, print and apply labels to your CD-ROMs or audio CDs. It's the essence of simplicity—one of those things that, when you've seen it in action, you say to yourself, "Gee, why didn't I think of that." As with many other worthwhile inventions, the Neato CD Labeler Kit was one that was conceived and born out of necessity.

MicroPatent is a leading provider of patent and trademark information, and CD-ROM is the media of choice for disseminating this information. In the course of producing their own CD-ROMs, the folks at MicroPatent also longed for a better means of labeling their disks, and the germ of an idea sprang to life. The way the story was related to me, some of the guys started dismantling an old Mr. Coffee machine and cannibalizing its parts to come up with some sort of jury-rigged device for positioning an applying an adhesive label to a one-off disc. After much trial-and-error work and a bit of tweaking here and there, the Neato CD Labeler Kit emerged in its current form.

The Neato package consists of: a precision positioning cone that looks like a child's spinner top; a precision cylindrical base piece; one PC-formatted diskette that contains label design templates for *CorelDRAW!* (Versions 3, 4 and 5), Aldus *PageMaker*, *FileMaker Pro*, MS *Word* and *Windows* .WRI formats; another 3½" diskette for Macintosh users that contains three label design templates for Aldus *PageMaker*, *FileMaker Pro 2.1* and *QuarkXpress* 3.3; 100 self-adhesive labels; the Neato instruction guide; and a Neato ordering form. You supply the laser printer, the application (*CorelDRAW!*, *Word*, etc.) for creating the label using one of the supplied templates and the disc to be labeled.

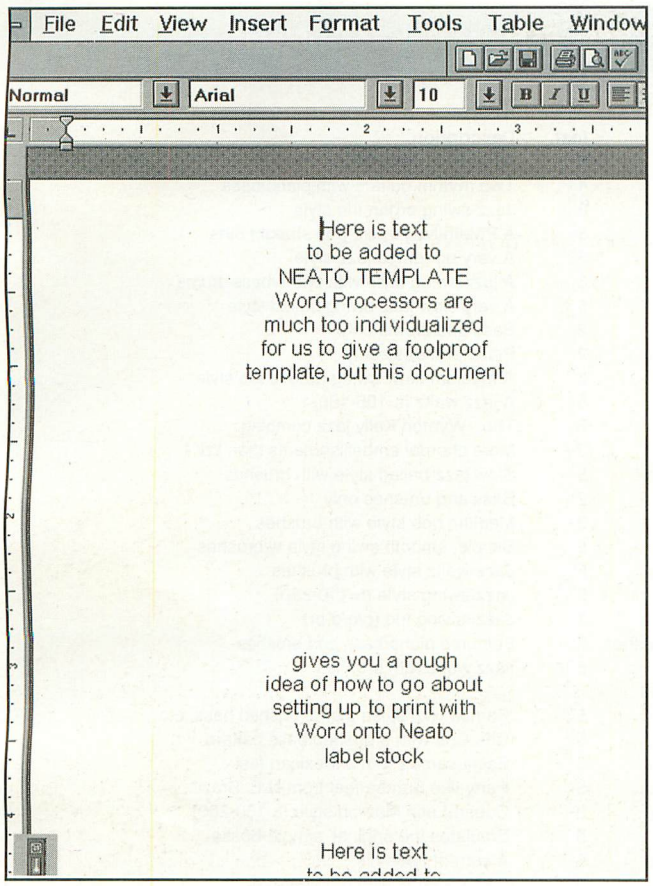


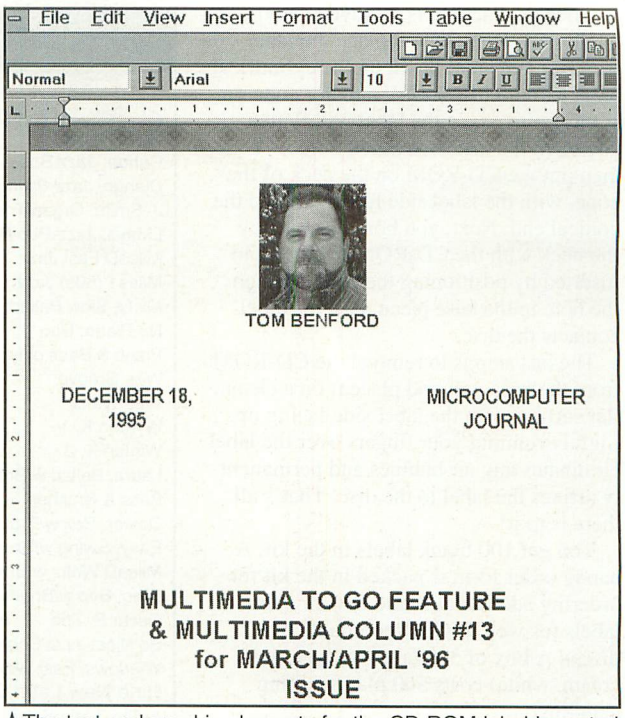
The Neato CD Labeler Kit comes with everything you need to design, print and apply your own audio CD/CD-ROM labels. Templates for popular graphics packages, including *WordPerfect*, MS *Word*, *CorelDRAW!* and others are provided for designing and creating labels, and the package ships with 100 blank gold-colored labels ready for printing and application. (Videographs by Tom Benford).

The process consists of opening the desired application on which to run the template, typing in your text and adding a graphic if you wish and sending it to the printer.

I used Microsoft *Word* 6.0 to create the label for the CD-ROM that contains my feature article, column and various .TIF and videograph files for this issue. I could have used *CorelDRAW!* 5.0, but since I write my articles in *Word* 6.0 and a template for *Word* (NEATOW20.DOT) is provided on the software, I figured "what the heck—let's give it a shot." So I did.

The template contains some dummy text located in the "safe" printable areas of the label. You merely substitute your own text for the dummy wording, select the typeface(s) and size(s) you desire, add a graphic or two if you wish and—*voilá!*—you're ready to print.





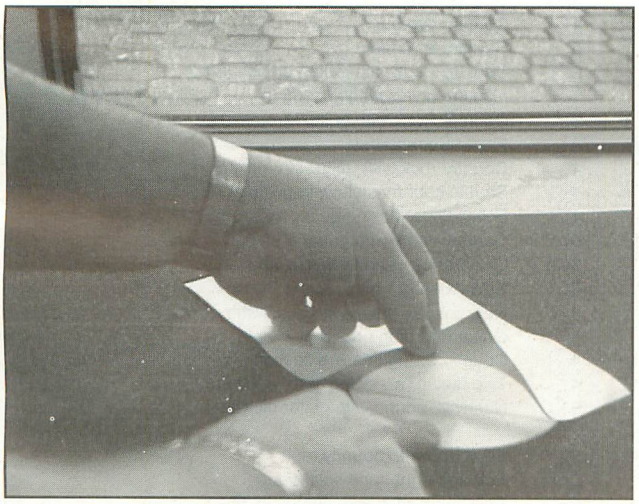
▲ The text and graphic elements for the CD-ROM label I created are shown in this screen capture. I used Microsoft *Word* 6.0, and I decided to embellish it with a .TIF file of myself.

◄ The various templates supplied with the Neato kit provide "dummy" text in safe areas that you replace with your desired wording and/or graphic elements. You can adjust point sizes, typefaces and be as creative as you wish, since you have complete control over the design.

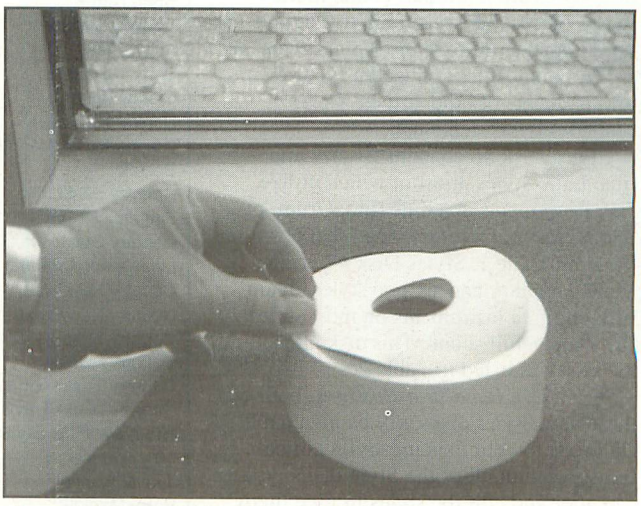
I ran a couple of trials using plain white bond on my laser printer (so as to not waste the label stock), and I held them up against the label stock against a window to make sure everything fell within the printable area. After a few minor adjustments to the text and graphic-element positioning, I was satisfied.

I loaded one of the label sheets into the manual-feed tray of the printer (an Okidata OL850 LED Pageprinter in my case) and clicked on Print from *Word*'s file menu. Within seconds, a very professional-looking label emerged, complete with my likeness at the top of it.

After the label emerges from the printer, the first step is to place it face down and peel the backing from it. Minimizing curling is desirable, since it will make applying the label a bit easier to accomplish. You can use a finger, pen or any pointed instrument to peel back the edge of the label. I prefer fingers, since they're always there when I need them.



The cylindrical base is shown with the label (sans adhesive backing) placed face-down on it. The entire process is so simple—and foolproof—it's amazing that nobody else ever thought of doing it this way.



The labels and their hub holes are die-cut as supplied in the kit. Placing the newly printed label face-down on a flat surface helps to minimize curling when the backing is removed.

Once the backing is removed and the hub hole is opened, you place the label face (printed side) down on the cylindrical base. Minor curling isn't a major concern at this point, since the label will flatten-out when the disc is lowered onto it. You then put the CD-ROM on the neck of the cone, with the label side facing toward the conical end. Next, you hold the cone by the neck with the CD-ROM in place and inserted by positioning the cone through the hole in the base piece until the label contacts the disc.

The last step is to remove the CD-ROM from the base unit and place it on a clean, flat surface with the label side facing up. Lightly running your fingers over the label eliminates any air bubbles and permanently affixes the label to the disc. That's all there is to it!

You get 100 blank labels in the kit. A handy order form is packed in the kit for ordering additional Neato Kits or extra labels (as well as CD-Recordable blank discs). A box of 300 labels (silver, gold, cream, white) costs $60 plus shipping handling.

If you're producing your own CD-ROMs or audio CDs, the Neato CD Labeler Kit is one of the most-useful and time-saving pieces of equipment you'll ever use. I love it and consider it to be indispensable.

Band-in-a-Box Styles Disk #6 and #7

It just keeps getting better and better for *Band-in-a-Box* users every time PG Music releases another styles disk. The latest releases are 30 jazz and Latin styles on Styles Disk #6 and 25 country and pop styles on Styles Disk #7. In keeping with PG's usual high standard of quality, these new styles are multi-part contemporary masterpieces that are certain to add new aural dimensions to your original *Band-in-a-Box* compositions as well as your own arrangements of other artists' works (called "cover" versions).

Styles Disk #6 contains 21 jazz and nine Latin styles, most of which utilize five instruments at a time (bass/drum, piano, guitar and strings). The breakdown is given in Table 1. Styles Disk #7 brings you 19 country and six pop styles, again utilizing five instruments on most styles for a super-full sound. This disk allocates the styles as listed in Table 2.

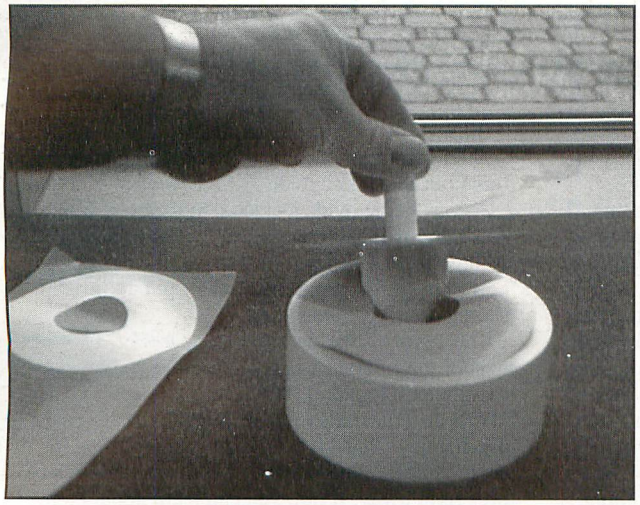
If you're a *Band-in-a-Box* user, both of these new Styles disks will be invaluable additions to your existing styles collections. As with all of the Style disks, you can alter and edit the styles to give them your own personal touches and preferences or combine different style elements to create totally original and unique styles from these very solid building blocks. At

Table 1. Styles Disk #6 Contents

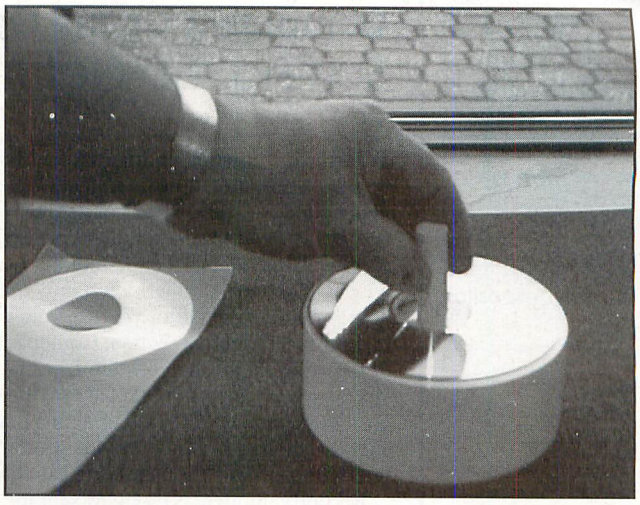
Style Name	Inst.	Description
21 New Jazz Styles		
Caribe, Jazz Bossa	3	Alternative Jazz-Bossa style
Django, Jazz Swing	4	Two rhythm guitars with piano/bass
J. Smith, Organ Trio	3	Jazz-swing organ trio style
LMays, Jazz-Pop Pad	5	A PMeth/Mays jazz-pop straight 8ths
MilesD Fast Jazz	3	A very up-tempo jazz style
Miles1 (50s) Jazz	3	A jazz swing style with piano/bass/drums
Misty, Slow Ballad	5	A very slow jazz-swing ballad style
No Piano, Duo	2	Bass and drums only
Piano & Bass only	2	Piano and bass only
Wes Groove	3	A medium-slow-swing groove trio style
Wes Waltz	5	A jazz waltz (t=105-180)
Wynton K, 1	3	Trio - Wynton Kelly jazz comping
Winton K, 2	3	More chordal embellishments than WK1
Laura, Ballad w/Brushes	5	Slow jazz-ballad style with brushes
Bass & Brushes	2	Bass and brushes only
Dexter, Box w/Brushes	3	Medium bob style with brushes
Easy, Swing w/Brushes	5	Simple, smooth swing style w/brushes
MilesD Waltz w/Brushes	5	Jazz-waltz style with brushes
Oleo, Bop w/Brushes	5	Jazz-swing style (t=110-250)
Oscar P. Trio	3	Jazz=swing trio (p/b/d-br)
So Nice, Jazz Bob w/Brushes	3	Features piano/bass and brushes
Windows, Fast Waltz	5	Jazz waltz with brushes
Nine New Latin Styles		
Arriba, Latin Salsa	5	Samba with salsa piano, pushed bass, etc.
Cha Cha New, Latin	5	Cha Cha with a pushed bass pattern
Churro, Mexican Samba	5	Salsa samba with a Mexican feel
Fiesta, Latin New Samba	5	Party-like Samba feel from N.E. Brazil
Havana, Cuban Mambo	5	Cuban-Latin Mambo style (t=100-200)
Jobim, Latin Bossa	5	Emulates the original, simple Bossa
Macarena, Dance Craze	5	A current Latin hit
Salsa, Latin Samba	5	Salsa Samba with p/b/g/mt-g/d
Serena, Latin Jazz	5	16th Rock-Bossa-Samba

Table 2. Styles Disk #7 Contents

Style Name	Inst.	Description
19 New Country Styles		
Country 2 Step	4	Country two-step
Achy Shaky	5	Country line dance
Boby Goldsbro	5	Country Rock with guitar, strings (8ths)
Clancy (Irish)	4	Irish 6/8 styles with accordion
Denver (Country)	5	Country Rock with guitar strumming
Do-see-Do (Squaredance)	4	Fiddle Squardance
Eagles	4	Country rock with guitar strumming
Country EZ Shuffle	4	Shuffle country style with guitar
Fingerpickin' Guitar	4	Folky, fingerpicking guitar style
Country Guitar Waltz	5	Country waltz with guitar & strings
Line Dance (Shuffle)	5	Line Dance - shuffle with swing feel
Country New Waltz	5	New Country Waltz - Cape Breton
Country New Balad	5	New country balad with guitar/strings
Country Simple 2 & 4	5	Guitar chording on 2 & 4
Country Swing	4	Country swing in a & b section
Country Texas Swing	4	Two feel in "a", swing in "b" section
Country Merle Travis	5	Nashville sound with guitar picking
Six New Pop Styles		
50's Bounce	5	Light pop with bouncy feel
Joni Mitchel piano	2	Left and right hand solo piano
Barry Manlow	5	Pop balad style with strings in "b"
Phil Collins	5	Slow pop balad style, 16th notes
Surfin'	5	Beach Boys, Jan & Dean type sound
Dance Tek 1	4	Techno-disco-dance rhythm



The CD-ROM is placed on the precision cone with the label side facing the conical end. As the cone is lowered into the cylindrical base, the label is automatically centered and positioned correctly when the disc makes contact with it.



The cone is lowered completely through the opening until it rests on the supporting surface. At that point, a few light touches to the disc ensures a good seal between it and the label.

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The Jazz Soloist is a music program with professional jazz quartet arrangements of 50 songs. Each song features a great jazz solo played by top jazz musicians, as well as piano (comping), bass and drums. There are more than three hours of jazz soloing on each volume, and each volume includes a stand-alone "Jazz Soloist" program with MIDI files. All files are also included in *Band-in-a-Box* format, and the *Windows* version includes notation and printout.

The program helps you learn to solo like a professional jazz musician. Musicians studying improvisation typically learn by copying other soloists performances. There are several key ingredients

(continued on page 114)

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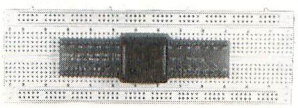
See the review in the March '96 issue of Electronics Now!

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CIRCLE NO. 68 ON FREE INFORMATION CARD



By Joe Desposito

Computing On the Go

Surfing the Net from All Across the USA

When I first opened an Internet account, I signed on with a provider in my area that offered three hours per day access for a $15 flat rate per month. I found this arrangement attractive, since it gave me plenty of time to explore the Internet while calling a local telephone number. I certainly didn't want an hourly rate (applied after you use your allotted flat-rate time) to America Online, CompuServe or any of the other established on-line services. Only once since I signed up with my local provider have I used more than my allotted time in a day and been shut off the Internet (my provider doesn't charge hourly rates). So I've been fairly satisfied.

Recently, though, NETCOM sent me a complimentary copy of *NetCruiser*, along with a free 60-day subscription. *NetCruiser* is an Internet browser. When I tried it out, I noticed three things. First, it's simple to use. All you have to do is load the program onto your PC from one 3½" floppy disk, set up the program to work with your modem, choose a local telephone number and dial. Your first time through, you need to register with NETCOM; after which you dial right into the Internet.

In contrast to this, I had quite a few problems with my local provider. First, I had to use my own communications software to access the provider's BBS. Then I needed to download several programs. First, was a copy of *RIPTerm*, which gave me a graphical interface to the provider's BBS. Next, was a copy of Trumpet Winsock. Finally, I had to download a copy of *Netscape*. It took me about a week to figure out how to get everything to work.

About *NetCruiser*

Besides being simple to use, *NetCruiser* starts you off with a graphical menu (Fig. 1) that contains links to many other sites. This helps you learn about sites you might not find so easily otherwise. Finally, and probably the best thing about *NetCruiser* for someone who's using a notebook computer is its database of local telephone numbers (Fig. 2). You can make a local call from most major cities and plenty of smaller ones. Is this better than having a provider with an 800 number? Yes it is.

Most Internet providers make sure you pay the cost of a toll-free number, one way or another, either through higher flat rates or as a surcharge. With *NetCruiser*, you can be assured of a $19.95 rate, without having to worry about the cost of the long-distance call, for the most part. This rate includes 40 peak hours (Monday through Friday, 9 a.m. to midnight) and unlimited off-peak hours. Additional peak hours are billed at the rate of $2 per hour. If there's no local number available where you are, you can dial a NETCOM 800 number, which is an additional charge of 8 cents per minute.

I installed *NetCruiser* on my Toshiba T3400CT, which has a TDK DF2814 PCMCIA modem. This modem, which runs at 28.8K bps, isn't listed on *NetCruiser*'s installation menu. However, the modem worked fine with the Hayes 28,800-bps setting.

After installing *NetCruiser* and dialing up, I found out that an upgrade of *NetCruiser*—Version 2.1—was being made available to users on-line. You can download the upgraded version just by selecting this choice from the File menu (Fig. 3). I didn't opt for this upgrade right away but, instead, decided to use version 2.00.

The icons just below the menu bar (Fig. 1) offer most of the Internet's best features, including electronic mail, Gopher, USENET newsgroups, Telnet, FTP (File Transfer Protocol), Finger and IRC (Internet Relay Chat). If you're an accomplished Internet "surfer," you may be able to use these features right away. If not, you can learn about them though *NetCruiser*'s Help menu.

Buttons along the bottom of the screen serve a variety of purposes. NETCOM and *NetCruiser* buttons provide information about the company itself and its flagship product. A button called "The Club" offers such services as WebNews (up-to-the-minute news articles from AP and Reuters), account information, technical support and more. The Search button gives you access to The McKinley Internet Directory, Clarinet's e.News services and InfoSeek's Net Search Service. This New button takes you to a page that tells you what's new in NETCOM's Website.

Version 2.00 works well enough, but it's terribly slow when browsing the World Wide Web, even with a 28.8K-bps modem. It reminds me of how Microsoft *Windows* used to perform when it was first being demonstrated on the IBM PC/XT. The problem lies in *NetCruiser*'s inability to let you do a partial browse of a site. You must wait until each page is completely downloaded before you can go on to the next page. This can take a considerable amount of time if a Web page contains large graphics files. Version 2.1 solves this problem, in a way, since it allows you to launch other Internet applications. In other words, you can replace the *NetCruiser* Web browser with different one, *Netscape*, for example.

Downloading the new version of *NetCruiser* is supposed to take about 15 minutes, but it took me an hour or so. After two aborted attempts at 19.2K bps (the recommended setting), I reduced my modem speed to 14.4K bps, which worked. The only visible difference in *NetCruiser* 2.1 is a choice in the File menu call Application Launcher. I decided to use this new feature to install the latest version of *Netscape* as my browser.

To obtain the latest version of *Netscape*, I simply used *NetCruiser* to access the *Netscape* home page and downloaded Version 2.0b3, a beta copy. After installing *Netscape* on my notebook, I ran the new version of *NetCruiser*. To use *Netscape* as my browser, I just selected Application Launcher from the File menu. The Launcher examined my hard disk, found *Netscape*, and loaded it as a part of *NetCruiser* (Fig. 4).

Compared to the setup I have with my local provider, I believe that *NetCruiser* with *Netscape* is a better solution. For one thing, it gives me a more

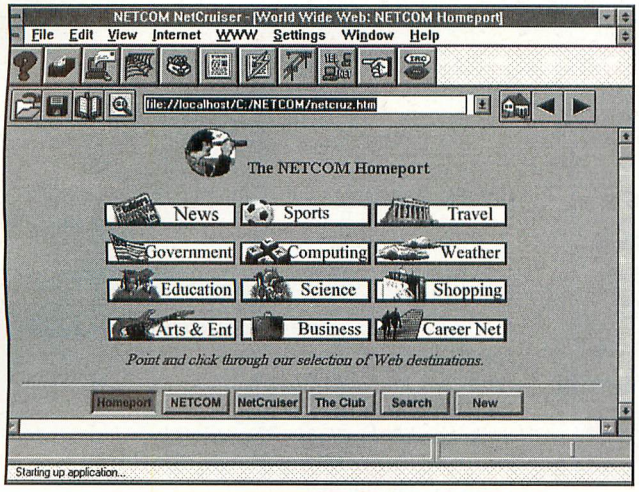


Fig. 1. *NetCruiser* starts you off with a graphical menu that contains links to many other sites.

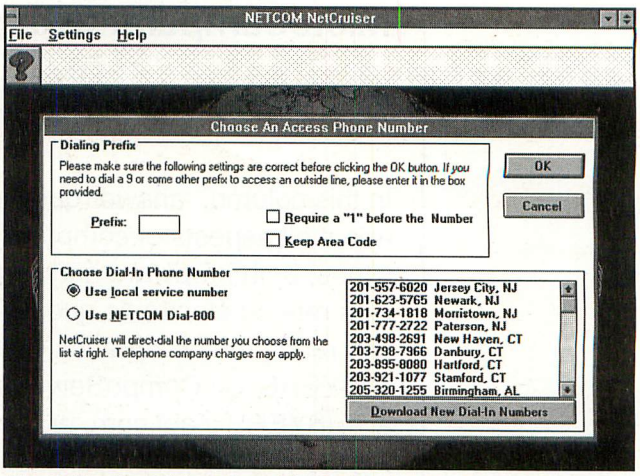


Fig. 2. The best thing about *NetCruiser* for someone who's using a notebook computer is its database of local telephone numbers.

complete array of tools with which to work (even though comparable tools are readily available on the Internet). Additionally, I can access the Internet more easily from different locations, without incurring additional expense—for the most part.

National Coverage

To give you a general idea of how well NETCOM has covered this great land of ours, the company has local access in more than 200 metropolitan areas, which gives it one of the largest Internet dial-up networks in the U.S. (NETCOM calls these sites POPS, for point-of-presence.)

From a technical standpoint, *NetCruiser* connects your PC to the Internet using SLIP (Serial Line Interface Protocol) with compressed leaders (CSLIP). This permits you to have full, direct access to all major Internet resources. CSLIP places you directly on the Internet via NETCOM's access service. When connected to the NETCOM network, your computer is assigned an IP address by the NETCOM system and can communicate directly with any other computer on the Internet.

NETCOM's nationwide network is built on a T1/T3 backbone. To manage this network, NETCOM has installed a full-time Network Operations Center, which is staffed 24 hours per day, seven days a week. A customer-service center is also staffed 24 hours per day year-round.

You may be interested to know that NETCOM plans to provide nationwide ISDN access for both personal and business users by the end of 1996. NETCOM will launch its ISDN service at 128K bps, which is more than four times as fast as the 28.8K bps I have on my notebook. (I'm planning to install an ISDN line in my office, but that's for another column.)

Though I used *NetCruiser* with Microsoft *Windows* 3.11, it's fully compatible with *Windows 95*, according to a company press release that was available on-line.

If you're thinking about obtaining a direct connection to the Internet, *NetCruiser* at $19.95 per month is a good economical choice. This is especially true if you travel frequently and can make use of the 200 POPs that NETCOM offers.

Company Information

NETCOM
3031 Tisch Way
San Jose, CA 95128
Tel.: 408-983-5950; Fax: 408-983-1537; http://www.netcom.com
CIRCLE NO. 203 ON FREE INFORMATION CARD

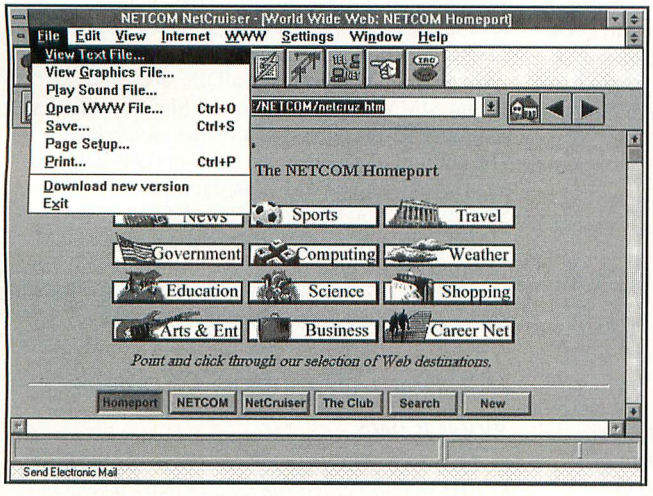


Fig. 3. You can download the upgraded version of *NetCruiser* just by selecting this choice from the File menu.

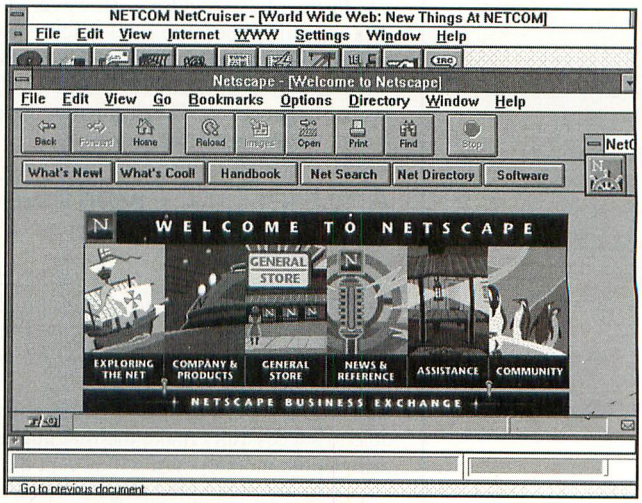


Fig. 4. The Launcher examined my hard disk, found *Netscape*, and loaded it as a part of *NetCruiser*.

Microcomputer Q&A

By TJ Byers

In this column, answer questions about all aspects of computer disciplines, both hardware and software, plus related electronic queries. You can reach me on America Online at TJBYERS, on CompuServe or Internet at TJBYERS@aol.com, or by mail at *MicroComputer Journal,* 76 N. Broadway, Hicksville, NY 11801.

DX4 OverDrive Upgrade

Q. *I have an Acer Acros multimedia PC with a 486-DX2/66 processor that I'd like to upgrade to DX4 performance using an Intel OverDrive CPU. However, my motherboard doesn't have an upgrade socket, which means I'll have to remove my old CPU and install the OverDrive chip in its place. However, I don't know if my current processor is 5-volt or 3.3-volt, and I've been told that you can't mix the two technologies. Yet nobody I've talked to knows what voltage the DX4 OverDrive uses. My question is, will the OverDrive chip work in my computer? One dealer mentioned a converter socket that translates the voltages from 5 volts to 3.3 volts. Do I need one of these converters, maybe?*—Richard Schisler, Ipava, IL

A. According to Acer, your Acros is DX4- and Pentium-compatible. All you have to do is remove your old CPU and replace it with the OverDrive chip of your choice. The confusion about the voltage technologies goes back to the original DX4 OverDrive introduced a couple years ago, which worked at 3.3 volts. To make the OverDrive chip compatible with 5-volt systems, the converter socket was invented. Basically, the converter is an adapter socket that has a built-in voltage regulator. However, its existence was short-lived because Intel quickly made the DX4 and Pentium OverDrive CPUs 5-volt tolerant. In other words, Intel put a 5-to-3.3-volt voltage regular inside the processor. Consequently, there's no longer a need for the converter socket.

Another DX4 OverDrive Question

Q. *Is it possible to upgrade my 486SX/25 system to the DX4 without swapping motherboards? I've already upgraded it once to the equivalent of a 486-SX/50 using an Intel OverDrive processor.*—Deborah Snow, Los Angeles

A. The answer is a qualified yes. Because you were able to successfully make the first upgrade, it's a safe bet the motherboard will accept the DX4 processor by simply unplugging the 486SX/50 OverDrive and replacing it with the new OverDrive. I doubt you'll have to change your jumper settings. Besides increasing your clock speed from 50 MHz to 75 MHz, you'll also gain a math coprocessor.

Mixing SIMM Types

Q. *I'd like to upgrade the memory of my son's 386-DX/40 computer from 4M to 8M. His system currently has four 1M, 80-ns SIMMs. Do I need to use exactly the same type of SIMMs or can I add the more-readily-available 70-ns SIMMs? Also, can I mix three-chip SIMMs with nine-chip SIMMs?*—Frank G., via Internet

A. It's perfectly okay to mix three- and nine-chip SIMMs. It's also okay to add faster SIMMs, which means you can use 70- or 60-ns SIMMs in your son's PC. However, don't expect the faster SIMMs to work any better than the existing 80-ns ones because the speed of the system isn't determined by the SIMM's speed but by more-basic factors, like the number of wait states.

Recycling 30-Pin SIMMs

Q. *I'm considering replacing my old 486DX2/66 motherboard with a new Pentium motherboard. However, my current system is loaded with 16M of 30-pin SIMMs, and the Pentium motherboards I've looked at use 72-pin SIMMs. The way I count it, my investment in 30-pin SIMMs comes to more than $500—an investment I'd like to vest, if at all possible. But no dealer is willing to take my old SIMMs in trade for the newer versions. Do you know of a motherboard that lets you use either type of SIMM?*—Elint One, via America Online

A. While I've seen some motherboards that support both types of SIMMs, I wouldn't recommend one. However, I've run across a device that'll solve your problem. It's the SimTree from Memory Conversion Products (Contact: Internet Memory Exchange at 503-688-9263). Basically SimTree, which comes in several different models to fit different PCs, is an adapter board that has four or eight 30-pin SIMM sockets on it. You populate all the slots with your 30-pin SIMMs and then plug the SimTree card into an empty 72-pin SIMM slot on the motherboard. The amount of memory the card supports depends on your existing SIMMs. For example, four 1M SIMMs nets you the equivalent of a 4M 72-bit SIMM, while eight 4M SIMMs is equal to a 32M 72-bit SIMM. Other providers of SIMM converter boards include Cameleon Technology (tel.: 408-436-8681) and SimmSaver (tel.: 316-264-2244).

Memory Upgrade Crashes *Windows*

Q. *I have a 386SX PC I recently upgraded from 2M to 10M so that I could run today's more demanding* Windows *software. Things worked just fine for a while. However, little by little, the system began to*

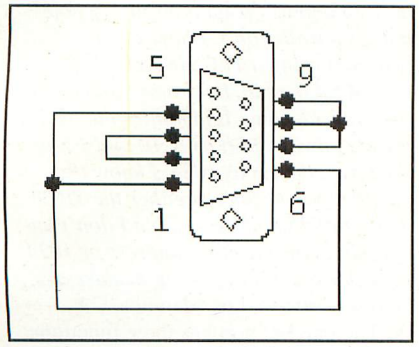


Fig. 1. This loopback connector is needed to test your home-brew serial port software. It works by jumpering the inputs to the outputs, and letting the software take control of the port speed and timing signals.

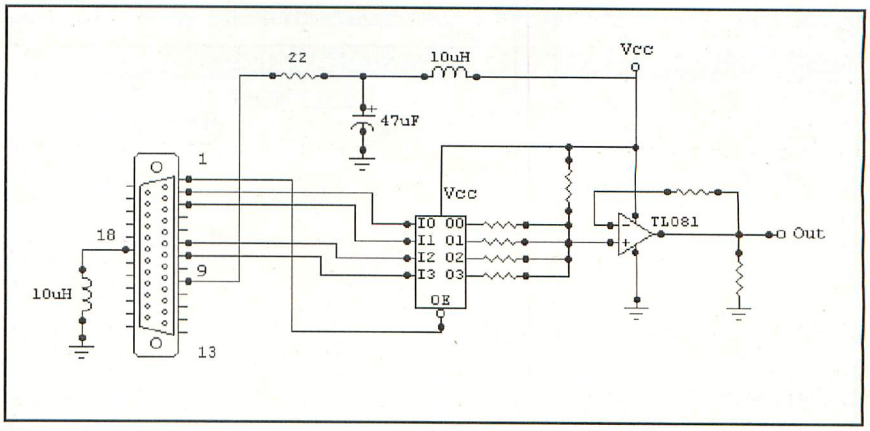


Fig. 2. This diagram shows how you can "steal" power from the parallel port using the D7 (pin 9) data line. Other likely candidates include the Initialize (pin 16) and Strobe (pin 1) lines.

degrade until the point where I can barely run it. For example, when I try to log onto AOL, I get an GPF error message about half the time that kicks me out of Windows. *The same thing occurs with* Quicken for Windows. *While the error messages vary, one seems to be consistent:*

Standard Mode: Bad Fault in MS-DOS Extender.
Fault: 000D Stack Dump: 0000 0000 0070

If I turn off or reboot my computer, I can sometimes get it to work without a problem, but there's no guarantee. What happened? Did my dealer sell me defective RAM chips?—JEMJEM1, via America Online

A. The GPF fault occurs when the number and size of the variables in all the .INF files collectively exceeds 32K (the limit of the Stack Register). Basically, an .INF file contains *Windows* information about the installed software and hardware devices in the system. This problem is, no doubt, a result of adding new applications after installing the extra RAM. To correct the problem, rename the newly added .INF files in the WINDOWS\SYSTEM directory to filenames with extensions other than .INF. If you discover .INF files that appear superfluous, they can be deleted. However, *never* rename or delete the SETUP-.INF file, otherwise *Windows* won't load. This file must remain unchanged.

QBasic Programming for the Serial Port

Q. *I need to send exactly 524,288 characters to a serial port on an 80486DX2/66 using GWBasic or QBasic. Because the program has to run on several different makes and models of PCs, I've written the following program to test the compatibility of the COM1 port.*

```
10 OPEN "COM1:9600,N,8,1,RS,CS,
DS,CD" AS #1
20 PRINT #1, "P";
30 X=X+1
40 PRINT X;
50 FOR TD=1 TO 1000:NEXT TD
60 GOTO 20
```

After a few seconds, though, the program simply stops. When I hit Ctrl+Break, the screen shows that the program is stuck on line 20. If I try to run the program again, it counts up to 127 and locks up again. Moreover, I can't detect any activity on the Transmit Data line (pin 4). What's causing the problem? Is there a fix?—Steve Everman, Hampton, IA

A. The problem is that your program contains several fundamental errors. First, you're not testing the COM1 port, you're testing the loopback capabilities of the I/O card. This is why you don't detect activity on your Transmit Data line. Second, you didn't specify the function of the OPEN command, which tells the program whether the port is output, input or bidirectional. Finally, there's no reason for line 50, unless you have a lot of time on your hands; with a properly written program, the COM port will set the pace for you, and you don't need the time delay. Here's how I'd approach the problem.

```
10 OPEN "COM1:9600" FOR OUTPUT
AS #1
20 PRINT #1, "P"
30 X=X+1
40 PRINT X
50 IF X= 524288 GOTO 70
60 GOTO 20
70 PRINT "Test Complete."
```

To run this program, you need a null modem loopback device connected to the COM1 port (Fig. 1). Optional line 40 serves no purpose other than to let you know the program is still running. If you eliminate this line, the test will run much faster. I'm sure there are other solutions, and I invite readers to submit their favorites for possible future publication.

Free Power From a Parallel Port

Q. *Paul Bergsman's article "Make Your*

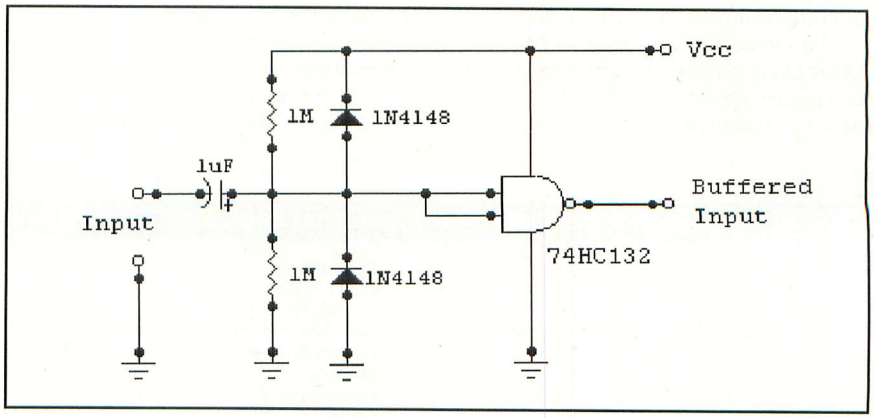


Fig. 3. Power can also be generated from the input signal, but the amount available is usually just a few microamperes.

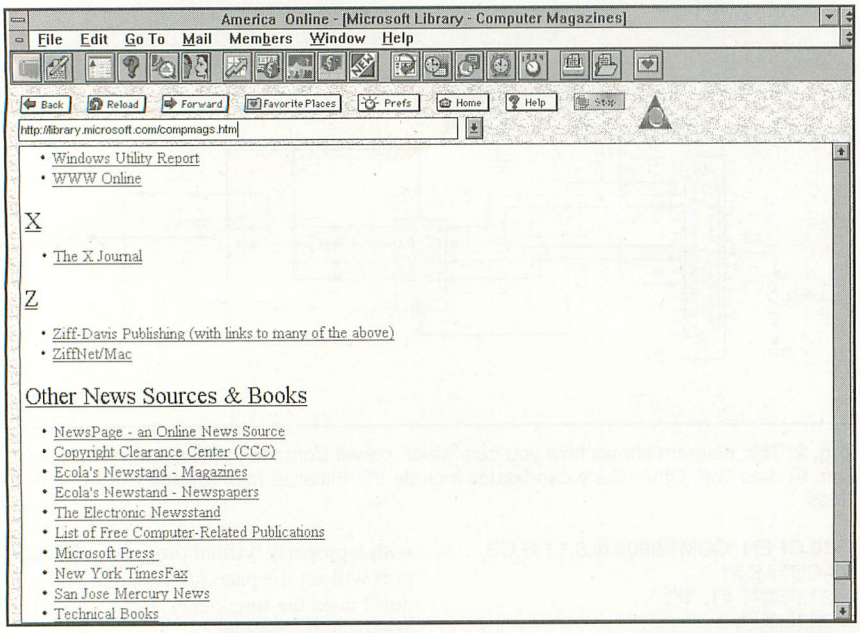


Fig. 4. Finding books and periodicals on the World Wide Web is as easy as falling off a log. A good site for computer magazines is http://library.microsoft.com/compmags.htm. Two excellent sources for books is Quantum Books at http://www.quantumbooks.com and the Waite Group at http:// www.dnai.com/waite.

PC Operate as a Multiple Metering Device" in the January/February issue of MicroComputer Journal *featured an interesting way to use the PC's parallel port. At the same time, it raised a question that I find puzzling. Mr. Bergsman's project uses a 9-volt battery, but I've seen ads in various magazines and catalogs for similar devices that say "no power required, simply plug into the parallel port and it's ready to use." Can you tell me how this is done?*—Surindar Singh, Victoria, Australia

A. Generally, it's done by stealing power from one of the parallel port's output pins. Figure 2 shows how it can be done using the D7 (pin 9) data line. With proper software programming, this pin can be set high all the time, which will them provide a solid source of 5 volts at up to 10 mA. Other likely candidates include the Initialize (pin 16) and Strobe (pin 1) lines, which, although not high all the time, have a very high duty cycle that appears constant enough to pass for a 5-volt source. You must be careful, though, that you provide adequate isolation between the signal source and the power load to prevent degradation of the signal. Maxim Integrated Products (tel.: 408-737-7600) carries a good line of semiconductors for this purpose. Power can also be generated from the input signal (Fig. 3), but the amount available is usually just a few microamperes—only enough to support a couple CMOS chips.

About Parallel-Port Registers

Q. *I use a 286 PC to record data from a homemade seismometer using a commercial analog-to-data converter (ADC) card plugged into my system. Now I'd like to take my act on the road, which means I need to import the data through a notebook's parallel port. I have a copy of a program using a TLC548 ADC that should fill the bill, but I don't understand the programming. It identifies the offsets for the parallel port as 8, 10 and 12, and the base address as 1024. I know that the parallel port resides at either the 3BCh, 378h, or 278h addresses, but I don't understand how the offset address or 1024 base address relates to these addresses.*—Henry Burwash, Los Alamitos, CA

A. The parallel port has three functions, each with an accompanying register. There's one register for data, another for control signals and yet another for status. The Data Register is located at the home port address, usually 3BCh, and the Control Register is located at 3BEh, with the Status Register sandwiched between the two at 3BDh. The offset is used to move between these registers so that you don't have to redefine them in the program each time you want to move from one to another (see Table 1). Often, these addresses are referenced to a unique base address so that the software can identify the source of the input, which is what I suspect the 1024 base number represents. I suggest you obtain the documentation for the software you have, or buy a good reference manual like *Interfacing to the IBM Personal Computer* (ISBN: 0-672-22722-3) published by SAMS (on the Internet: http://mcp.com/ sams).

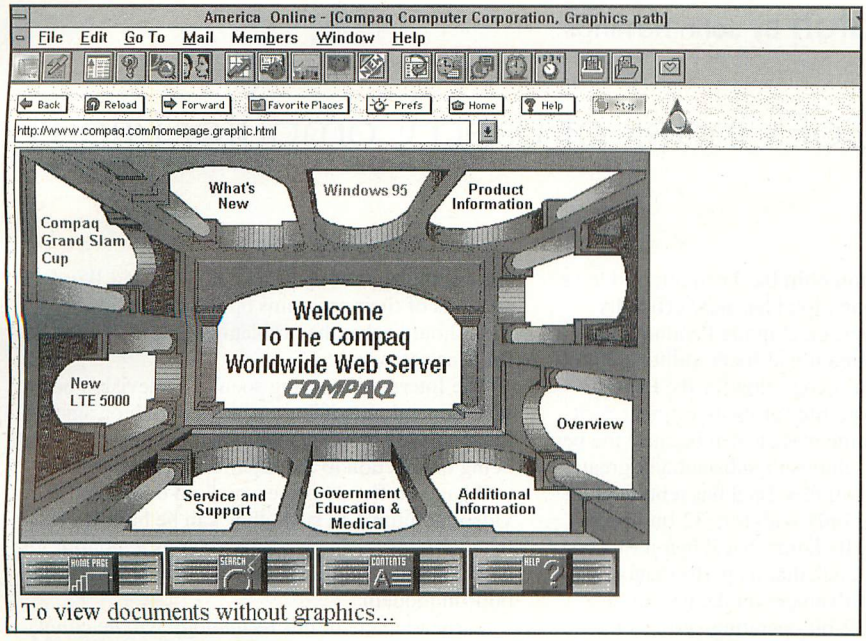
Table 1. Parallel Port Programming Registers.

Port Name	Offset	Mode	Read/Write	Description
SPP Data Port	0	SPP/EPP	W	Data Register
SPP Status Port	1	SPP/EPP	R	Reads Input Status Lines On Interface
SPP Control Port	2	SPP/EPP	W	Sets State Of Output Control Lines
EPP Address Port	3	EPP	R/W	Generates Interlocked Address Read Or Write Cycle
EPP Data Port	4	EPP	R/W	Generates Interlocked Data Read Or Write Cycle
Not Defined	5 to 7			Used Differently By Various Implementations

Parallel-Port *Windows* Programming

Q. *I've built a parallel port interface for my PC that's very similar to those described by Jan Axelson in her articles. Originally I used Jan's DOS programs to control the I/O, A/D and timer chips. My software is written in C, and it directly controls the various registers of the parallel port. Now that I'm ready to upgrade to* Windows, *how can I write the same program for* Windows 3.1*? Do I still write to the parallel port registers directly, or do I have to make some kind of* Windows 3.1 *call, instead?*—Peter Cheng, via Internet

A. The fact that you have hands-on experience with hardware and C programming is a big plus. That's because *Windows* is largely written in C, which means a good portion of your present programming can be converted to *Windows* with only minor changes. What changes, you ask? That I can't say without going through your code with a fine-tooth comb. In some cases making a direct hardware call is more productive than using a *Windows* API call. But only a good programmer knows which call to make and when — just like a good coach knows when to punt. I suggest



User tip. I recently acquired a used Compaq Deskpro 286 with a dead Lithium battery. The battery was easy enough to replace, but after the machine wouldn't boot properly because the EPROM's memory was long gone. Since I'm not the original purchaser of the machine, I didn't have the documentation or, more importantly, the diagnostic/setup software. After several unsuccessful attempts at contacting Compaq's literature department, I decided to go Web surfing. To my surprise, I found a treasure chest chock full of Compact software located at www.compaq.com.—*Lowell O. Turner, via Internet*

you get a good book on *Windows* programming (Fig. 4), or take a course at your local community college. Good luck!

Programming Multitask Operations in *Windows*

Q. *I would like to experiment with background hard-disk operations in a multitasking environment. Specifically, I'd like to be able to request a disk read and then have the application go to sleep until its data is ready. The system would then skip to another program, like a data-processing task, while it grabs bits and pieces of the requested data from the disk by stealing some CPU cycles to store the data in memory. I have a homemade* FORTRAN *operating system that I can readily modify to meet these demands, once I learn what moves to make. Can you recommend a book or magazine article that will show me how to do this?*—David Arnold, Kirksville, MO

A. You've just described the *Windows* environment to a tee. So I suggest you learn how to program in *Windows*, rather than trying to re-invent the wheel with your *FORTRAN* operating system. Not only do you gain a proven GUI (Graphical User Interface), but you can find disk access modules as you describe already written and debugged. There are a couple good books that should get you started: *Windows Programming Primer Plus* (ISBN: 1-878739-21-2) and *Windows API Bible* (ISBN: 1-878739-15-8), both written by Jim Conger. As for magazine articles, they're numerous. I suggest you search the Web (Fig. 4) for them.

Assembly-Language Programming for a Math Coprocessor

Q. *In the July 1993 issue of* Computer Craft, *Hardin Brothers wrote a very informative article on assembly language that tells how to utilize the 80387 math coprocessor. However, I need more details, like specific examples of how I can use it in my programs. Can you recommend a book on the subject?*—Ralph Hoyt, Birdsboro, PA

A. That article goes way back—way before we changed our name to *Micro-Computer Journal*. I recently spoke with Hardin Brothers, who told me that he got his information from one or more Intel manuals. These references are still available by contacting Intel at http://www.intel.com. I'm told that a good book on the subject is *Programmers Technical Reference: The Processor and Coprocessor* by R.L. Hummel (ISBN 1-56276-016-5). To find a list of other assembly-language books, check out the Internet site at http://alaska.net/~rrose/book.htm.

PCMCIA Run-Around Solved?

Q. *I'm getting really tired of the PCMCIA runaround. Despite heroic efforts from several hardware vendors and my local dealer, I still can't make my PCMCIA flash memory cards work with my PCMCIA fax/modem. Do you know something they don't that will let these cards work together?*—Jon Younger, via Internet

A. I doubt it. Very seldom do I get more than one PCMCIA card to work in a system. While some of the blame can be placed on the different dialects of hardware standards, where flash memory calls it "tomatoe" and the fax/modem calls it "tomato," most of the problem can be attributed to the way the vendors write their PCMCIA drivers. If you're old enough to remember, this is the same problem that kept SCSI down for so many years. While *Windows 95* attempts to cure the problem with Plug and Play (PnP), it falls way short of the mark. If your PCMCIA device isn't listed in *Windows 95*'s short list of devices, you have to choose the Enabler option. Unfortunately, the Enabler won't let you do hot-swapping, where you can plug and unplug PCMCIA cards while the system is running. So much for Plug and Play. However, there may be a light at the end of the tunnel. SystemSoft (tel.: 508-651-0088) has released *Card Wizard Pro*, a program that uses an artificial intelligence (AI) engine to sort out the PCMCIA conflicts. While I've never used *Card Wizard Pro*, I hear that it does miracles at making mixed PCMCIA cards work together.

Windows 95 Load Error

Q. *When I try to start some of my programs in Windows 95, I get the message Load error detected ct3dv2.dll. However, the Explorer tells me that the file exists in the Windows directory and is working fine. What gives?.*—T. Carey, via America Online.

A. Unfortunately, you weren't specific as to which programs cause the problem, but I have to assume they're part of *Windows Office*, which seems to be the worst offender. In this case, you're getting the error because you attempted to remove files while in maintenance mode. The solution is to go into the application itself and delete the file from there. ■

Industry Watch By John Hastings

The AmCoEx Index of Used Computer Prices

Intel's 686-generation chip has been referred to as the P6 for several years. Intel has now officially named the next generation chip the Pentium Pro. The company explained it had spent millions of dollars of advertising for recognition for the Pentium name and wanted more life for its investment. Critics charge that the name was chosen because the performance of the new chip isn't substantially greater than the fastest P5 Pentiums. Intel has rebutted that the new chip is faster only with true 32-bit operating-system software. It claims that *Windows 95* contains so much 16-bit code that its performance will show little or no improvement on the new chip. However, with true 32-bit operating systems like *Windows NT*, performance will be twice as fast as the current Pentiums.

This is very bad news for the companies and individuals who have recently upgraded to *Windows 95*. The life span of the new operating system will be much shorter than many people expected. When the Pentium chips fall in popularity, *Windows 95* will fall with them. This will force *Windows* users to adopt the *Windows NT* operating system. While large and slow by today's standards, hopefully new CPU chips will give *Windows NT* faster performance. One chip that may extend the life of *Windows 95* has been developed by Cyrix. The company's M1 chip, as it's called, runs about 30% faster than the fastest Pentiums. Some people doubt Cyrix can produce enough chips to meet the expected demand.

Apple Computer can't manufacture enough Macintosh computers to meet current demand. Several years ago, the company attempted to address this problem by permitting other companies to manufacture clones of the Macintosh. Today's supply problem, however, hinges on shortages of Apple-supplied components. Hence, if the company can't make enough proprietary components for its own computers, it can't supply clone makers, either. The solution to this dilemma will come during this year with the Common Hardware Reference Platform. CHRP is a computer made from industry-standard parts that will be able to run the Macintosh operating system with no dependency on Apple-supplied hardware. These PowerPC-equipped computers will also be able to run *Windows NT* and OS/2.

IBM and Motorola expect to have several new versions of the PowerPC CPU chip ready for the new CHRP computers. Some of these chips are expected to run at speeds in excess of 500 MHz. Compaq, Dell, Zenith, IBM and numerous other computer makers are expected to manufacture the new computers. This manufacturing capability should certainly eliminate the supply problems for the Macintosh.

Software availability problems should be solved soon through use of hybrid CD-ROMs. Many software companies are putting both Mac and *Windows* versions of their programs on the same CD-ROM. This should solve the problem of lack of shelf space for Mac software.

The Internet is coming soon to a television near you. Several manufacturers are working on small, inexpensive computers with their sole purpose in life being connection to the Internet. These computers will have no floppy drives, no hard drives and no video monitors. As such, they can be built for less than $200. By using a TV receiver as a monitor, the new computer will need only a keyboard, CPU and built-in modem.

Early adopters of this technology will be companies in the travel industry. Virtually every hotel room and airport lounge in the world will soon be equipped with the new computers. As volume increases and prices fall below $100, these devices will be as common in home use as is the VCR now. E-mail addresses will become ubiquitous throughout all developed countries in the world. Most of our mail, including our bills, will be delivered electronically. When security issues are addressed, most payments will be made electronically.

As the fax machine decimated the overnight letter business, e-mail will force the postal services to rethink how it does business. With the reduced volume of mail, catalog distribution will become more expensive. Many companies will rely upon the World Wide Web for their electronic catalogs. While not as invasive as regular mail, someday e-mailing lists will surely permit merchants to fill our e-mail boxes with junk e-mail.

In the early 1970s, an independent computer programmer wrote an application for microcomputers. He signed an agreement with a marketing company to market his program. The agreement stated the programmer would receive a percentage of profits after expenses. Month after month, the marketing company stated that there were no profits after expenses. In a fit of rage, the programmer decided to give away his program for free, requesting users to send him a small fee in appreciation. The programmer made a great deal of money, the marketing company went broke, and the concept of shareware was born. Since then, thousands of programs have been released for distribution with a request for payment after usage.

On the other end of the spectrum, well established programs like *Lotus 1-2-3* continued to sell for $500 or more. Competition and proliferation of computer users in recent years caused the prices to fall precipitously. In an effort to increase revenues, software companies have bundled several applications into one package. These are often referred to as "suites." While the cost of programs is falling, the price of the package remains fairly high. The next step may be free software. IBM acquired Lotus primarily for its

Prices For Used-Computer Equipment as of October 25, 1995

Machine	Average Buyer's Bid	Average Seller's Ask	Close	Change ($)
IBM PS/1 486DX2/50, 253M	$500	$900	$625	–25
IBM PS/2 Model 90, 160M	625	950	700	–100
IBM ThinkPad 350C	1,200	1,700	1,300	–100
IBM ThinkPad 700	800	1,200	900	—
IBM ThinkPad 720	1,000	1,500	1,150	+25
IBM ThinkPad 755c	2,600	3,300	2,825	–150
AST 486SX/25, 170M	450	850	650	+100
AST 486DX/66, 340M	600	1,000	775	+75
AST Pentium 90, 540M	1,400	1,800	1,500	–25
Dell 486DX/33, 240M	500	950	675	+25
Dell Pentium 75, 1G	1,500	2,300	1,600	–75
Gateway 486/33, 120M	500	700	650	—
Clone 486/25, 120M, VGA	450	800	525	–175
Clone 486DX/33, 240M	475	900	675	+100
Clone Pentium 60, 540M	1,050	1,600	1,275	25
Compaq Contura 4/25, 120M	650	1,000	-800	+75
Compaq Deskpro 486/33, 120M	650	1,100	675	–125
Mac IIci, 80M	400	850	450	–100
Mac Performa 630, 250M	900	1,350	1,025	–100
Mac Quadra 700, 230M	700	1,100	825	–50
Mac Quadra 800, 500M	900	1,500	1,150	—
Mac 7100/80AV, 700M	1,700	2,600	1,800	–200
Mac 8100/80, 1G	1950	3,000	2,100	–250
PowerBook 170, 40M	700	1,150	850	+25
PowerBook 180, 80M	1,000	1,750	1,175	—
PowerBook 520, 250M	1,250	1,600	1,450	+150
PowerBook 540c, 320M	2,100	2,750	2,300	+75
LaserWriterPro 630	1,100	1,650	1,275	–75
NEC Versa, 340M	1,900	2,600	2,100	–175
Toshiba 1960CS, 320M	1,400	1,900	1,500	–75
Toshiba 3200 SXC, 120M	1,500	2,450	1,650	–75
Toshiba 4800CT, 500M	2,200	2,900	2,325	–100
HP LaserJet II	350	800	400	–50
HP LaserJet IIIP	250	650	300	–50
HP LaserJet III	450	800	500	–25
HP LaserJet IV	800	1,200	900	—

Notes networking software. To help sales of its desktop and notebook computers, IBM is considering including free copies of the Lotus *SmartSuite* bundle with each new computer. Other software companies will have a difficult time matching this offer.

More News

For many years, the computer industry has looked toward Microsoft and Intel for leadership and future direction. Microsoft has provided the standards in software, while Intel has provided the critical hardware. The harmony between these two companies has permitted this dual leadership to prosper. However, the relationship between the two giants has become strained. For years, Microsoft has developed operating-system software for many of Intel's most serious competitors.

Recently, Intel seems to have stopped dancing to Microsoft's tune. Intel's next generation CPU chip, the P6, does nothing to enhance the performance of Microsoft's new *Windows 95*. While the new chip, recently named the Pentium Pro, gives reasonable performance increases to Microsoft's *Windows NT*, the life span of *Windows 95* has certainly been shortened by this strategy. *Windows 95* will live only as long as the middle-aged original Pentium (the Pentium Amateur?).

If the Microsoft/Intel relationship deteriorates further, some people predict Microsoft will form closer ties with other chip makers. Some have even suggested that Microsoft may attempt to acquire Digital Equipment Corp. Its Alpha chip is, by far, the most-powerful processor on the market. The Justice Department would look closely at this union, but it may be forced to permit it, based on the fact that both IBM and Apple control the hardware for their software. This coalition wouldn't bode well for the future of Intel.

Very few computer hardware companies have successfully managed software products. In hardware, when a product doesn't meet expectations, it's quickly discontinued. Software, on the other hand,

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Prices For Used Equipment as of November 27, 1995

Machine	Average Buyer's Bid	Average Seller's Ask	Close	Change ($)
IBM PS/1 486DX2/50, 253M	$500	$900	$625	—
IBM PS/2 Model 90, 160M	625	950	750	+50
IBM ThinkPad 350C	1,000	1,550	1,200	–100
IBM ThinkPad 700	800	1,200	875	–25
IBM ThinkPad 720	1000	1,500	1,200	+50
IBM ThinkPad 755c	2,600	3,300	2725	–100
AST 486SX/25, 170M	450	850	600	–50
AST 486DX/66, 340M	600	1,000	775	—
AST Pentium 90, 540M	1,200	1,600	1375	–125
Dell 486DX/33, 240M	500	950	600	–75
Dell Pentium 75, 1G	1,150	1,600	1400	–200
Gateway 486/33, 120M	500	700	600	–50
Clone 486/25, 120M, VGA	450	800	550	+25
Clone 486DX/33, 240M	475	900	625	–50
Clone Pentium 60, 540M	1,050	1,600	1,175	–100
Compaq Contura 4/25, 120M	650	900	750	+50
Compaq Deskpro 486/33, 120M	650	950	725	+50
Mac IIci, 80M	400	850	425	–25
Mac Performa 630, 250M	900	1,350	950	–75
Mac Quadra 700, 230M	700	1,100	825	—
Mac Quadra 800, 500M	900	1,500	1,025	–125
Mac 7100/80AV, 700M	1,500	2,400	1,775	–75
Mac 8100/80, 1G	1750	2,600	1,975	–125
PowerBook 170, 40M	600	950	775	–75
PowerBook 180, 80M	900	1,350	1,050	–125
PowerBook 520, 250M	1,250	1,600	1,375	–75
PowerBook 540c, 320M	2,100	2,750	2,175	–75
LaserWriterPro 630	1,100	1,650	1,200	–75
NEC Versa, 340M	1,900	2,600	2,000	–100
Toshiba 1960CS, 320M	1,400	1,900	1,475	–25
Toshiba 3200 SXC, 120M	1,500	2,450	1,525	–125
Toshiba 4800CT, 500M	2,200	2,900	2,225	–100
HP LaserJet II	350	800	400	—
HP LaserJet IIIP	250	650	325	+25
HP LaserJet III	400	750	525	+25
HP LaserJet IV	800	1,100	825	–75

Since 1988, the American Computer Exchange has matched buyers and sellers of used microcomputer equipment. For more information contact the American Computer Exchange at 800-786-0717 or http://www.crl.com/~amcoex.

requires time to evolve to a successful level. The first versions of Microsoft's *Word*, *Excel* and *Windows* were dismal failures by most standards. Over time, they've come to dominate their markets. Hardware executives tend to "pull the plug" too soon. Novell, a software company headed by a hardware executive, is now facing this change. The company is trying to sell its *WordPerfect* division, along with other software products.

In an uncharacteristically persistent manner, IBM has continued to push its OS/2 operating system. This persistence is now beginning to pay dividends in the corporate marketplace. Corporations are largely shunning Microsoft's new *Windows 95*. While 7-million copies of *Windows 95* have been sold, only 3-million were purchased outright and 4-million copies were pre-installed on new computers. Most of these sales were to individuals for home use.

Most corporations continue to order new computers with the older *Windows* 3.1 or OS/2. Many corporations feel *Windows 95* has no future, since it won't run well on the next generation Pentium Pro computers. Until major improvements are made in *Windows NT*, OS/2 is poised to make major penetration into Microsoft's market share. To add insult to injury, IBM may include its newly-acquired Lotus *SmartSuite* with OS/2 at no extra charge.

Apple Computer set record sales during the third quarter of 1995. While this isn't an uncommon occurrence, the sales were large enough to regain some of the market share Apple has lost in the past two years. This increase in market share is most remarkable in light of the fact that the third quarter was the one in which Microsoft introduced *Windows 95*. Many people thought *Windows 95* would eliminate any advantages the Macintosh had over Wintel (*Windows*/Intel) computers. Apparently, many computer users don't agree.

The record sales figures for Macintosh computers seems to demonstrate that the demand is almost insatiable. In fact, Apple still has a backlog of orders of more than a billion dollars. Macintosh clone manufacturer Power Computing is selling all of the computers it can manufacture. In its first year of operation, Power's sales will exceed 100,000 computers. While this is a small number by today's standards, it's still more computers than Compaq sold in its first year of operation. Today, Compaq outsells all other computer makers.

Apple's inability to produce specialty parts has held back total production of the Macintosh computers. The new specifications for Macs that don't require these specialty parts will be announced this month. These new computers will permit Apple and licensed clone makers to manufacture Macs with off-the-shelf parts. The result will be significantly less-expensive computers in great abundance.

While videophones have been discussed for years, the reality may be right around the corner, due primarily to the large installed base of home computers. Utilizing existing computers, the additional hardware and software can be very inexpensive. This is key to widespread adoption, and widespread adoption is key to serious utilization. Compaq announced it will offer the Intel chipset that will permit video transmission as an option. While the complete setup could add more than $800 to the cost of the computer, less-expensive alternatives are available. Connectix Corp. is offering a VideoPhone hardware/software package for both Macintosh and *Windows* computers that will sell for less than $150. Users can see and talk to each other over a network, the Internet or standard telephone lines.

As newer digital telephone lines become common, other manufacturers will rush more products into this marketplace. The quality and speed of the video will increase to usable rates and prices will fall even more. A key factor will then become standardization. When these factors are addressed during the next three to five years, millions of Americans will begin to do more work at home. Productivity will increase as commute time will be turned into productive time. Less money will be wasted on cars, gasoline, buildings and parking lots. Millions of students will attend schools without leaving home. Instead of spending money on classrooms and parking facilities, schools will apply those funds to the development of easy-to-understand, high-tech education materials.

RAM Buyers					
Buyer	DIP	SIPP	30-Pin SIMM	72-Pin SIMM	SRAM
Add-On America Corp.	o		o	o	
Computers Made Simple			o	o	
Eastern 21			o		
Internet Memory Eochange			o	o	
Memory Depot	o	o	o	o	o
Memory Experts		o	o	o	
Micro Master	o	o	o	o	
Silicon Purchasing			o	o	o
Songtech International		o	o	o	
The Memory Liquidators	o		o	o	

SIMM, has a capacity of 4M (4MB), uses parity (X9), has a speed of 80 ns, has three (3) chips on the module and costs $139.

An ad for a 72-pin module might look like this:

72-pin SIMM Modules
1X36-4MB-70ns $165

This tells you that the module is a 72-pin SIMM, has a capacity of 4M (4MB), uses parity (X36), has a speed of 70 ns and costs $165. Notice that a module with parity has an X36 designation, while one without parity would have an X32 designation.

The capacity for 4M and greater-capacity modules is determined by dividing 36 by 9 (or 32 by 8) and multiplying the result by the number in front of the X, which in this case is 1 X (36/9 X 1 = 4 M). Keep in mind that there's no standard way to advertise SIMM parameters, but you won't be able to make pricing comparisons until you know all of the parameters.

Sometimes, suppliers advertise RAM for particular computer models, which makes it easier for you to order additional RAM. For notebook computers, in particular, you order RAM by manufacturer and model, rather than by deciding on the type of SIMM you need.

Notebook computers use proprietary modules instead of standard SIMMs. Many notebooks accommodate only one memory module, which can contain as much RAM as you can afford. Thus, if you want to upgrade a notebook PC from 4M to 16M, you must purchase a 12M module. It's usually very easy to upgrade memory on a notebook PC. You simply slide away a door on the computer's case, plug the new module into a socket and replace the door.

As with notebook PCs, you order printer memory by manufacturer and model number. Upgrading memory on a printer is usually more difficult than with a notebook computer, requiring you to disassemble several parts of the printer. Printer memory may be packaged on proprietary modules or SIMMs.

• ***New RAM Technologies.*** DRAM chips have been around since personal computers came into existence. Recently, however, several new RAM technologies have been developed. For DRAMs, there's now EDO (Extended Data Out) and burst EDO technologies, while for SRAMs there's pipelined burst technology. If you aren't familiar with how a DRAM chip operates, you may want to review the "How a DRAM Operates" box before continuing.

Fast Page Mode (FPM) was the fastest way to read memory before EDO DRAMs became available. With FPM, the read cycle begins when the row address is strobed as the RAS* (Row Address Strobe) signal falls. This is followed by the column address being strobed as the CAS* (Column Address Strobe) signal falls. To continue Fast Page within the same row address, the column address changes while cycling CAS*. Each time CAS* goes high, the output drivers are turned off, which then disables the data.

In the EDO read operation, as with FPM, the row address is strobed when RAS* falls and the column address is strobed when CAS* falls. But unlike FPM, the output drivers are *not* turned off when CAS* goes high. So the data isn't disabled. This permits a new access to begin at the next column address while strobing for data in the current column address. This time savings permits a faster page cycle time, increasing performance as much as 1.6 times.

Burst EDO was developed by the Micron Corp. Also termed "pipeline nibble mode," burst EDO is basically an EDO DRAM that contains a pipeline stage and two-bit burst counter.

The difference between burst EDO and standard EDO is that all cycles, READ and WRITE, occur in four-cycle bursts. Due to the internal pipeline stage, the first falling edge of CAS* during READ cycles doesn't produce data as with the EDO DRAM. It takes two CAS* cycles to produce the first data, after which each CAS* cycle delivers data.

Burst EDO was designed to achieve zero-wait-state performance at 66 MHz and beyond. Currently, FPM and EDO DRAMs achieve zero-wait-state performance at 28 and 40 MHz, respectively. According to Micron, burst EDO achieves a 100% increase in performance over FPM and a 33% to 50% increase over EDO DRAMs.

Just as DRAMs are improving in performance, so are SRAMs. A pipelined burst SRAM takes advantage of burst-mode operation and address pipelining available with the Pentium processor. This type of device integrates input registers, a two-bit burst counter and high-speed SRAM in a single chip.

• ***DRAM Pricing.*** Since most people tend to upgrade system DRAM, let's take a look at some DRAM pricing. As you're probably aware, DRAM pricing can vary quite bit from vendor to vendor and has a tendency to change from day to day. Unlike most electronic products, however, the price of DRAM doesn't go down. Well it does go down, but it goes up, too. This is why there is a market for used RAM.

At the time of this writing, the current catalog for a major distributor listed a 30-pin, 4M (X9), 70-ns SIMM for $175 and a 72-pin, 8M (2X36), 70-ns SIMM for $399. I scouted the mail-order vendors and found the same type 30-pin SIMM for $139, a savings of $36, and the same type 72-pin SIMM for $330, a savings of $69.

If you're quality-conscious, keep in mind the manufacturers I mentioned earlier in the article. Before you buy, ask who manufactures the SIMM. If

Upgrade Suppliers

Aberdeen
9728 Alburtis Ave.
Santa Fe Springs. CA 90670
Tel.: 310-801-5626 or 800-552-6868; fax: 310-801-5629

CIRCLE NO. 123 ON FREE INFORMATION CARD

ACE Micro, Inc.
7258 Clairemont Mesa Blvd.
San Diego, CA 92111
Tel.: 619-569-8380 or 800-455-9555; fax: 619-569-1319

CIRCLE NO. 124 ON FREE INFORMATION CARD

Add-On America Corp.
653 Old Mill Rd.
Millersville, MD 21108
Tel.: 800-576-2349; fax: 410-987-3258

CIRCLE NO. 125 ON FREE INFORMATION CARD

American Micro Products Technology
5351 Naiman Pkwy.
Solon, OH 4139
Tel.: 216-498-9499 or 800-619-0508; fax: 216-349-6170

CIRCLE NO. 126 ON FREE INFORMATION CARD

AmRam
2059 Camden Ave. #330
San Jose, CA 95124
Tel.: 408-975-2440; fax: 408-975-2446

CIRCLE NO. 127 ON FREE INFORMATION CARD

ASAPc Direct, Inc.
3847 West Oakton St.
Skokie, IL 60076
Tel.: 708-673-1300 or 800-404-PC2U; fax: 708-673-2300; Internet: http://www.asapc2u.com

CIRCLE NO. 128 ON FREE INFORMATION CARD

Autotime
6605 SW Macadam
Portland, OR 97201
Tel.: 503-452-8577; fax: 503-452-8495; Internet: http://www.teleport.com/~autotime

CIRCLE NO. 129 ON FREE INFORMATION CARD

Avalon Micro Liquidators
688 #D Wells Rd.
Boulder City, NV 89005
Tel.: 702-293-2300 or 800-610-1012; fax: 702-293-4453

CIRCLE NO. 130 ON FREE INFORMATION CARD

Cameleon Technology, Inc.
2081 Bering Dr., Unit L
San Jose, CA 95131
Tel.: 408-436-8681 or 800-440-7466; fax: 408-436-8685

CIRCLE NO. 131 ON FREE INFORMATION CARD

CompuAmerica, Inc.
295 Ocean Pkwy.
Brooklyn, NY 11218
Tel.: 718-871-3368 or 800-974-2392; fax: 718-436-4952

CIRCLE NO. 132 ON FREE INFORMATION CARD

Compustar Computers
61A Church Ave.
Brooklyn, NY 11218
Tel.: 718-853-7888 or 800-369-5411; fax: 718-854-1820; Internet: http://www.prismdesign.com/cstar

CIRCLE NO. 133 ON FREE INFORMATION CARD

Computers Made Simple, Inc.
1229 W. Washington
Chicago, IL 60607
Tel.: 800-900-7450; fax: 800-524-0233

CIRCLE NO. 134 ON FREE INFORMATION CARD

Data Memory Systems
24 Keewaydin Dr., Unit #5
Salem, NH 03079
Tel.: 603-898-7750 or 800-662-SIMM; fax: 603-898-6585

CIRCLE NO. 135 ON FREE INFORMATION CARD

Dee One Systems
1550 Centre Point Dr.
Milpitas, CA 95035
Tel.: 408-262-8938 or 800-831-8808; fax: 408-262-2826

CIRCLE NO. 136 ON FREE INFORMATION CARD

Deniz Corp.
401 East Fourth St., Bldg. #15
Bridgeport, PA 19405
Tel.: 610-275-6780; fax: 610-275-6782

CIRCLE NO. 137 ON FREE INFORMATION CARD

Eastern 21, Inc.
13001 Ramona Bl., Ste. #K
Irwindale, CA 91706
Tel.: 818-813-3896 (Ext. 108); fax: 818-813-3895

CIRCLE NO. 138 ON FREE INFORMATION CARD

Eritech Int'l.
740 N. Glendale Ave.
Glendale, CA 91206
Tel.: 800-808-6242; fax: 818-502-5059

CIRCLE NO. 139 ON FREE INFORMATION CARD

First Computer Systems
6000 Live Oak Pkwy., Ste. 107
Norcross, GA 30093
Tel.: 770-441-1911 or 800-325-1911; fax: 770-441-1856

CIRCLE NO. 140 ON FREE INFORMATION CARD

First Source Int'l.
7 Journey
Aliso Viejo, CA 92656
Tel.: 714-448-7750 or 800-942-9866; fax: 714-448-7760

CIRCLE NO. 141 ON FREE INFORMATION CARD

Galaxy Computers, Inc.
423 S. Lynnhaven Rd., Ste. 109
Virginia Beach, VA 23452
Tel.: 804-486-8389 or 800-771-4049; fax: 804-498-1211

CIRCLE NO. 142 ON FREE INFORMATION CARD

GIFI, Inc.
20814 Aurora Rd.
Cleveland, OH 44146
Tel.: 216-662-1910 or 800-739-9137; fax: 216-662-4761

CIRCLE NO. 143 ON FREE INFORMATION CARD

H&J Electronics Int'l., Inc.
2700 W. Cypress Creek Rd.
Ft. Lauderdale, FL 33309
Tel.: 305-971-7750 or 800-275-2447; fax: 305-979-9028

CIRCLE NO. 144 ON FREE INFORMATION CARD

H.Co. Computer Products
16812 Hale Ave.
Irvine, CA 92714
Tel.: 714-833-3222 or 800-347-1273; fax: 714-833-3389

CIRCLE NO. 145 ON FREE INFORMATION CARD

Hi-Tech USA
1550 Centerpoint Dr.
Milpitas, CA 95035
Tel.: 408-262-8688 or 800-831-2888; fax: 408-262-8772

CIRCLE NO. 146 ON FREE INFORMATION CARD

IDER
9080 Telstar Ave., #303
El Monte, CA 91731
Tel.: 818-288-0709; fax: 818-288-0797

CIRCLE NO. 147 ON FREE INFORMATION CARD

Internet Memory Exchange
Tel.: 503-688-9263

CIRCLE NO. 148 ON FREE INFORMATION CARD

InterPro Microsystems, Inc.
46560 Fremont Blvd., Ste. 417
Fremont, CA 94538
Tel.: 510-226-7226 or 800-226-7216; fax: 510-226-7219; Internet: http://www.shicho.com/shicho/compcentral

CIRCLE NO. 149 ON FREE INFORMATION CARD

Jameco Computer Prods.
1355 Shoreway Rd.
Belmont,, CA 94002-4100
Tel.: 1-415-592-8097 or 1-800-831-4242; fax: 1-415-592-2503

CIRCLE NO. 150 ON FREE INFORMATION CARD

JDR Microdevices
1850 South St.
San Jose, CA 95112
Tel.: 408-494-1400 or 800-538-5000; fax: 800-538-5005

CIRCLE NO. 151 ON FREE INFORMATION CARD

LA Trade
22825 Lockness Ave.
Torrance, CA 90501
Tel.: 310-539-0019 or 800-433-3726; fax: 310-539-5844

CIRCLE NO. 152 ON FREE INFORMATION CARD

Legend Micro
5590 Lauby Rd.
Canton, OH 44720
Tel.: 216-497-8620 or 800-366-6333; fax: 216-497-3156; Internet: http://www.industry.net/legend

CIRCLE NO. 153 ON FREE INFORMATION CARD

Megatech
3070 Bristol Pike
Bensalem, PA 19020
Tel.: 215-244-8189 or 800-214-5455; fax: 215-244-9056

CIRCLE NO. 154 ON FREE INFORMATION CARD

Memory 4 Less
2622 W. Lincoln, Ste. 104
Anaheim, CA 92801
Tel.: 714-826-5981 or 800-821-3354; fax: 714-821-3361

CIRCLE NO. 155 ON FREE INFORMATION CARD

Memory and CPU Whse.
8361 E. Evans Rd., Ste. 105
Scottsdale, AZ 85260
Tel.: 602-443-0696 or 800-RAM-7091; fax: 602-443-0918

CIRCLE NO. 156 ON FREE INFORMATION CARD

Memory Conversion Prods.
428 NW Ninth St.
Corvallis, OR 97330
Tel.: 503-753-7918 or 800-809-1379; fax: 503-758-5331

CIRCLE NO. 157 ON FREE INFORMATION CARD

Memory Depot
Tel.: 800-755-0586; fax: 619-551-8824

CIRCLE NO. 158 ON FREE INFORMATION CARD

Memory Experts
1404A Nevada Hwy.
Boulder City, NV 89005
Tel.: 800-252-5959; fax: 702-293-7686

CIRCLE NO. 159 ON FREE INFORMATION CARD

Memory Express
15140 Valley Blvd.
City Of Industry, CA 91744
Tel.: 818-333-6389 or 800-877-8188; fax: 818-369-1236

CIRCLE NO. 160 ON FREE INFORMATION CARD

Memory Megastore
2910 Franks Rd.
Huntingdon Valley, PA 19006
Tel.: 215-947-7669 or 800-372-7666; fax: 215-947-7440

CIRCLE NO. 161 ON FREE INFORMATION CARD

Micro-Assist
145 Hudson St.
New York, NY 10013
Tel.: 212-343-7953 or 800-390-7428; fax: 212-274-9193

CIRCLE NO. 162 ON FREE INFORMATION CARD

Micro Master
6585 Commerce Blvd., Ste. 196
Rohnert Pk., CA 94928
Tel.: 800-515-5005; fax: 805-783-1942

CIRCLE NO. 163 ON FREE INFORMATION CARD

MicroMax
700 Avenger Dr.
Virginia Beach, VA 23452
Tel.: 804-431-4500 or 800-795-6299; fax: 804-431-4448

CIRCLE NO. 164 ON FREE INFORMATION CARD

Micro Pro, Inc.
5400 Brookpark Rd.
Cleveland, OH 44129
Tel.: 800-353-3003; fax: 216-661-2454

CIRCLE NO. 165 ON FREE INFORMATION CARD

Micro Time, Inc.
35375 Vokes Dr., Ste. #106
Eastlake, OH 44095
Tel.: 216-954-9640 or 800-834-0000; fax: 216-954-9648

CIRCLE NO. 166 ON FREE INFORMATION CARD

Micro Xperts
6230 Cochran Rd.
Solon, OH 44139
Tel.: 800-73MICRO; fax: 216-498-3390

CIRCLE NO. 167 ON FREE INFORMATION CARD

Motherboard Discount Ctr.
3701 E. Baseline Rd., Ste 107
Gilbert, AZ 85234
Tel.: 602-813-6547 or 800-486-2026; fax: 602-813-8441; Internet: http://www.home-page.com/mall/mrupgrad.html

CIRCLE NO. 168 ON FREE INFORMATION CARD

Motherboard Express
333-C West State Rd.
Island Lake, IL 60042
Tel.: 800-560-1195; fax: 708-487-4637

CIRCLE NO. 169 ON FREE INFORMATION CARD

Motherboards Int'l.
8361 E. Evans Rd. #107
Scottsdale, AZ 85260
Tel.: 602-596-5226; 800-499-3970; fax: 602-596-1554; Internet: http://www.mother-boards.com/intl/

CIRCLE NO. 170 ON FREE INFORMATION CARD

NCA Computer Prods.
1202 Kifer Rd.
Sunnyvale, CA 94086
Tel.: 408-567-1777; 800-NCA-1115; fax: 408-567-1915

CIRCLE NO. 171 ON FREE INFORMATION CARD

Notebook Supersource, Inc.
111 Corporate Blvd.
S. Plainfield, NJ 07080
Tel.: 908-755-8328; 800-511-0505; fax: 908-755-0024

CIRCLE NO. 172 ON FREE INFORMATION CARD

Pacific Computer Prods.
1255 Birchwood Dr.
Sunnyvale, CA 94089
Tel.: 800-733-9730; fax: 408-734-4800; Internet: http://www.pcp.com/pcp

CIRCLE NO. 173 ON FREE INFORMATION CARD

PC Expert
459 Lexington Ave.
New York, NY 10017
Tel.: 212-818-1835; 800-365-8988; fax: 212-818-1267

CIRCLE NO. 174 ON FREE INFORMATION CARD

PC Importers, Inc.
8295 Darrow Rd.
Twinsburg, OH 44087
Tel.: 800-886-5155; fax: 216-487-5242

CIRCLE NO. 175 ON FREE INFORMATION CARD

PC InterActive
8295 Darrow Rd.
Twinsburg, OH 44087
Tel.: 800-347-3807; fax: 216-487-5242

CIRCLE NO. 176 ON FREE INFORMATION CARD

it's one of these companies, you shouldn't have any problems.

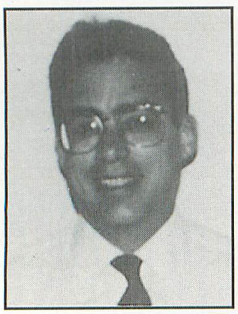
• ***RAM Converters.*** Suppose you upgrade your motherboard and it contains only 72-pin connectors. If you're really determined to recycle your 30-pin SIMMs, you can purchase a 30-pin-to-72-pin connector from various companies. The usual configuration converts four 30-pin SIMMs into one 72-pin SIMM and costs about $25. But you can also find converters that convert eight 30-pin SIMMs into one 72-pin SIMM.

If you have older DIP and SIPP DRAMs, Memory Conversion Products sells devices that convert these into SIMMs (1M DIP only). Finally, there are converters that will convert four 30-pin SIMMs into one 30-pin SIMM or two 72-pin SIMMs into one 72-pin SIMM. These effectively add more DRAM connectors to your motherboard. For a representative listing of converter suppliers, see the RAM Converter Suppliers table.

• ***Selling RAM.*** If you don't want to convert your old DRAM, you may want to sell it. The market for old DRAM is an active one and includes all the variations. You can expect to get about $10 to $20 per megabyte. Some of the companies that buy used RAM are listed in the RAM Buyers table.

Conclusion

Motherboard and DRAM upgrades are among the most-popular in the PC community. If you're contemplating one or the other or both of these upgrades, I hope this article has armed you with all the information you'll need to take you to a higher level of computing performance.



Joe Desposito

PC Int'l.
8295 Darrow Rd.
Twinsburg, OH 44087
Tel.: 800-458-3133; fax: 216-487-5242

CIRCLE NO. 177 ON FREE INFORMATION CARD

SeeWhy Computer Systems
1424B South Azuza Ave.
West Covina, CA 91791
Tel.: 800-275-1668; fax: 818-916-1080

CIRCLE NO. 178 ON FREE INFORMATION CARD

Sermax Corp.
1751 Second Ave.
New York, NY 10128
Tel.: 212-410-1597; 800-209-7126
Fax: 212-410-0452; Internet:
http://www.simmstack.com

CIRCLE NO. 179 ON FREE INFORMATION CARD

Silicon Purchasing
5900 Lilley #116
Canton, MI 48187
Tel.: 313-981-6364; fax: 313-981-2682

CIRCLE NO. 180 ON FREE INFORMATION CARD

SimmSaver Technology, Inc.
228 N. Pennsylvania
Wichita, KS 67214
Tel.: 316-264-2244; fax: 316-264-4445

CIRCLE NO. 181 ON FREE INFORMATION CARD

SoftHard Systems Enterprises, Inc.
3580 Sheridan Dr.
Amherst, NY 14226
Tel.: 716-834-2125; fax: 716-834-2079;
Internet: http://www.soft-hard.com

CIRCLE NO. 182 ON FREE INFORMATION CARD

Songtech Int'l., Inc.
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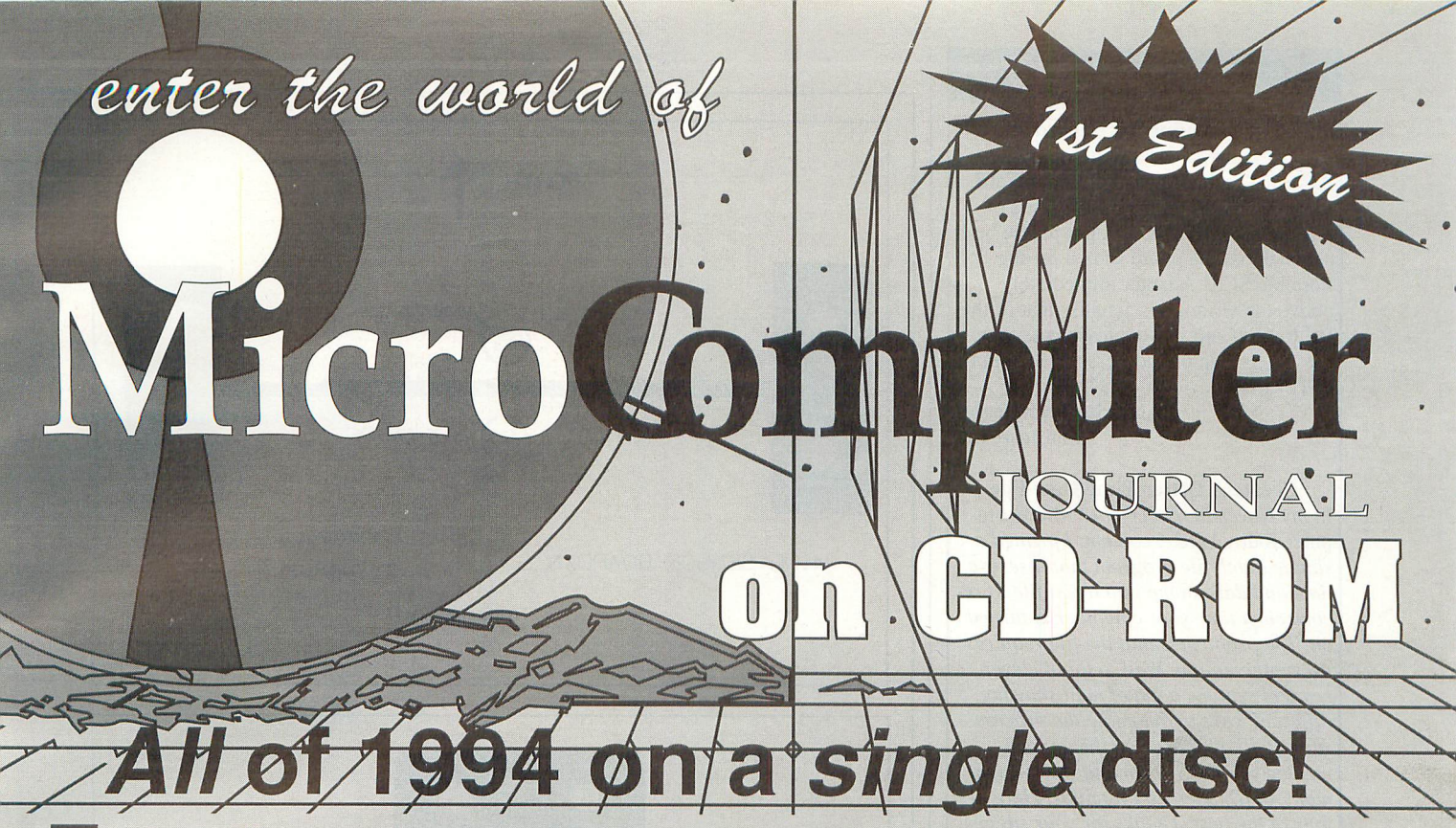
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Letters

Correcting the Record

• Many thanks for the write-up of the Accurite Technologies PC ReportCard in the January/February 1996 issue of *MicroComputer Journal*, but please be advised that the photo shown for the Portable SCSI Adapter immediately above the write-up is actually that of the PC ReportCard. Also, please note that the zip code in our address 95131—not 95121 given.

Accurite Techologies
San Jose, CA

Create A Better Time/Date File

In my November/December Microcomputer Journal *Q&A column, I printed a simple batch file program that inserts a time and date stamp into a text file to record each time your computer is turned on. The problem is that the file requires user intervention. Well, a lot of clever readers sent me a ton of mail showing different ways to automate the process. Almost all are based on the undocumented >> DOS command with which many UNIX users are familiar. Here are four of the best. Thanks for your suggestions.—TJ Byers*

• In response to TJ's time/date batch file, I discovered a way to write a file that doesn't need operator input to work. The trick is to create a companion file that contains the Enter character. This file can be created from the DOS prompt by typing the following.

```
COPY CON CR.DAT
Enter
F6
```

This done, here's the batch file, which I call BOOTLEG.DAT.

```
ECHO OFF
REM
REM Put time & date stamp in the BOOT-
LEG.DAT file at boot-up
REM
DATE < CR.DAT | FIND "Current" >> BOOT-
LEG.DAT
TIME  < CR.DAT | FIND "Current" >> BOOT-
LEG.DAT
```

To make the process work, copy both files to the C:\DOS directory and add the line C:\DOS\CALL BOOTLEG.BAT to your AUTOEXEC.BAT file.—Pete, via Internet

• In the November/December issue of *MicroComputer Journal*, TJ Byers published a batch file that generates a time and data stamp on boot-up. I'd like to show you the batch files I came up with that are a little smaller than the one TJ gave and, I think, have a nicer output.

The following file works with all versions of DOS 3.1 and later. Basically, the MORE command, combined with FIND, is the linchpin of this batch file.

(Continued on page 95)

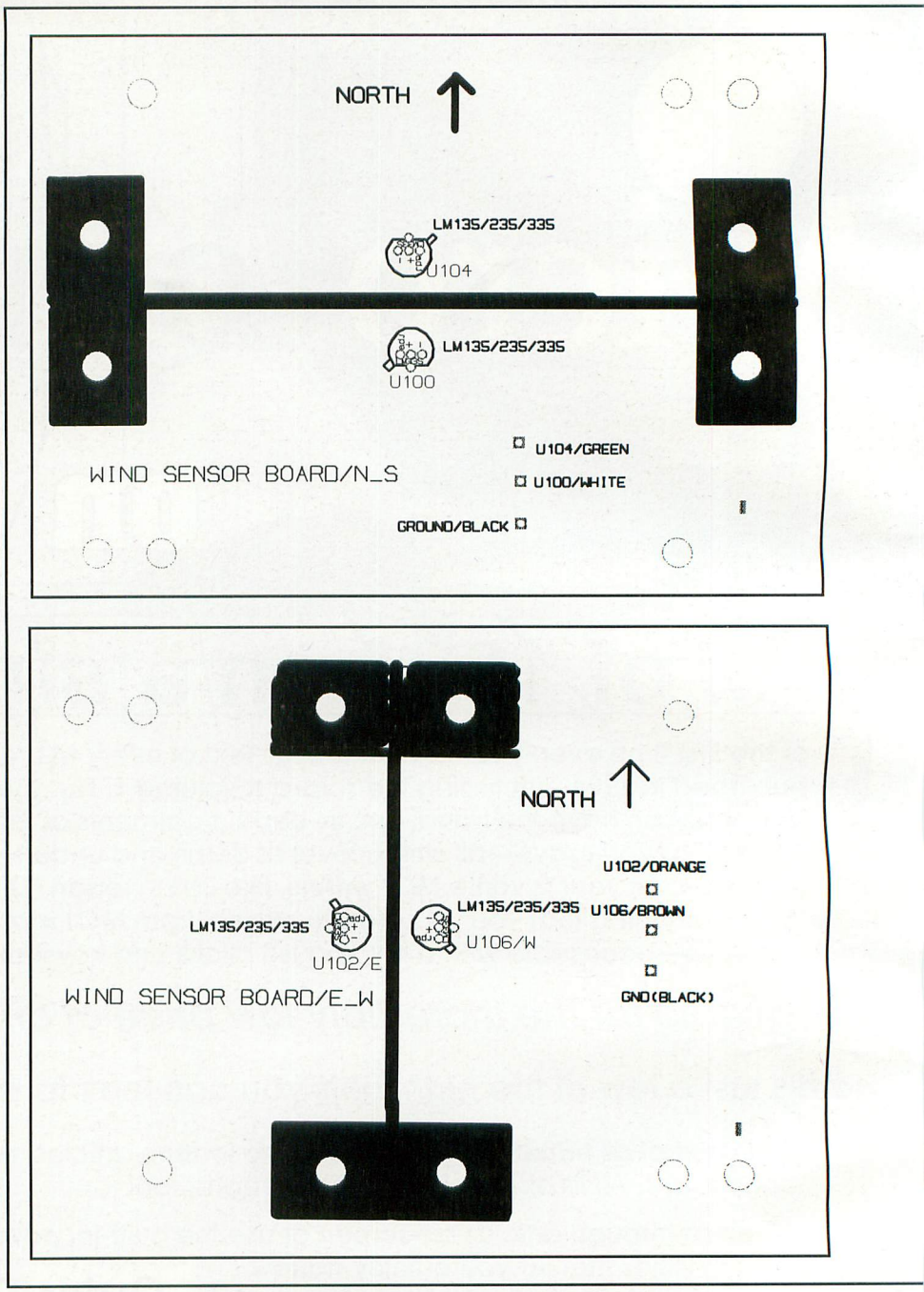


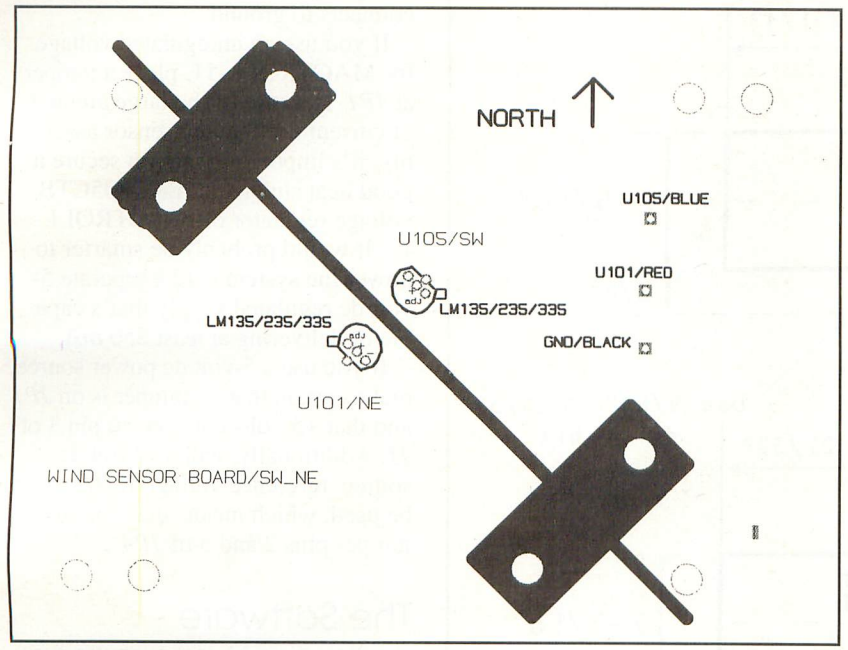
Fig. 4. Wiring guides for Sensor Boards.

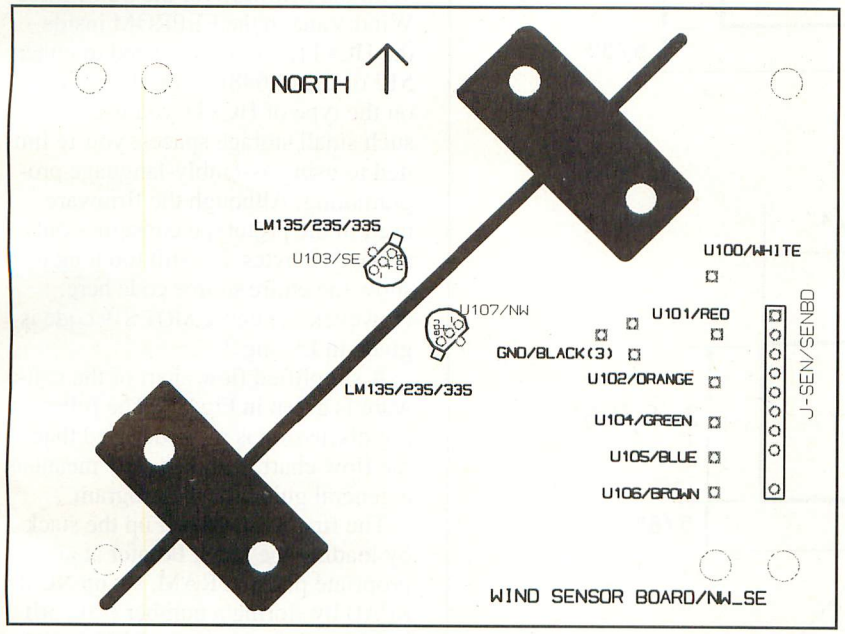
gle-sided PC board, the etching-and-drilling guide for which is given in Fig. 11. Assemble this board per the wiring guide shown in Fig. 12.

There are two connectors on the Display Board for PORT B. This increases the versatility of the Solid-State Wind Vane since it can be easily hooked up to another computer system for automatic recording or even forecasting without disconnecting its own display. Shown in Fig. 13 is a photo of the completed Display Board assembly.

• ***Cables & Connectors.*** You need four nine-conductor ribbon cables that have suitable 0.1" single-row connectors and 10 positions. Slot 9 is left without a contact. You should insert keying plugs in the slot-0 positions for polarization purposes.

A number of manufacturers make suitable connectors, though I've used AMP MT connectors in my projects. Sources for these connectors include Digi-Key Corp. and Mouser Electronics. For each connector, you need a 10-position single-row MODU Hous-





ing (AMP No. 1-87499-7, Digi-Key Cat. No. A3019-ND, Mouser Cat. No. 571-1874997), nine contacts (AMP No. 87667-3, Digi-Key Cat. No. A3000-ND, Mouser Cat. No. 571-876673), a keying plug (AMP No. 86286-1, Digi-Key Cat. No. A3077-ND, Mouser Cat. No. 538-15-04-9209) and a suitable cable.

Though special expensive tools are available for crimping the wire to the contacts, if you exercise care, you can use long-nosed pliers and a soldering iron with great effectiveness. When connecting to J-PORTE, take special notice of its rather odd pinout arrangement.

Connect these cables into the Wind Vane project as follows:

(1) J-MISCL connector on MAG-TROLL-11 to one J-MISCL connector on the Display Board

(2) The other J-MISCL connector on the Display Board to J-MISCL connector on the Op-Amp Board

(3) J-PORTE connector on MAG-TROLL-11 to J-PORTE connector on the Op-Amp Board.

Letters

(from page 94)

The MORE command acts like an Enter function and the FIND command displays the line with date and time. The >> symbols create and then append the date and time to the BOOTLOG.TXT file each time the program runs. The ECHO/ >> BOOTLOG.TXT line puts a blank line between each boot entry to separate the date and time.

```
@ECHO OFF
ECHO | MORE | DATE | FIND "C" >> BOOT-
LOG.TXT
ECHO | MORE | TIME | FIND "C" >> BOOT-
LOG.TXT
ECHO/ >> BOOTLOG.TXT
```

The next batch file takes advantage of the more-powerful features available in DOS 5.0 and later. It uses the "/" command after ECHO to do the same thing as the MORE command.

```
@ECHO OFF
ECHO/ | DATE | FIND "C" >> BOOTLOG.TXT
ECHO/ | TIME | FIND "C" >> BOOTLOG.TXT
ECHO/ >> BOOTLOG.TXT
```

If you put these lines at the end of your AUTOEXEC.BAT file, you'll have a nice little log of each boot, which will look like this:

```
Current date is Thu 11-16-1995
Current time is 4:30:22:35

Current date is Thu 11-17-1995
Current time is 4:40:11:10
```

I hope your readers find these files useful.—Gary Preston, via Internet

• I've created a BASIC program that simplifies the job of writing a time/date batch file. To create the file, simply type in the following lines of code in either *QBasic*, *Basica* or *GWBasic*:

```
OPEN "logfile.bat" FOR OUTPUT AS #1
   tmpString$ = "ECHO " + CHR$(10) +
"|time>>log"
   PRINT #1, tmpString$
   tmpString$ = "ECHO " + CHR$(10) +
"|date>>log"
   PRINT #1, tmpString$
CLOSE #1
```

Then run the program. While the finished batch file appears truncated (with only two lines of text), it has embedded code that gets the job done. Specifically, this program puts a carriage return (CHR$(10)) in the batch file, which automates the time/date process. After you create the batch file, place it in the C:\DOS directory and add the line LOGFILE.BAT to your AUTOEXC.BAT file.—William Ip, **Wardrop Engineering Inc.**, via CompuServe

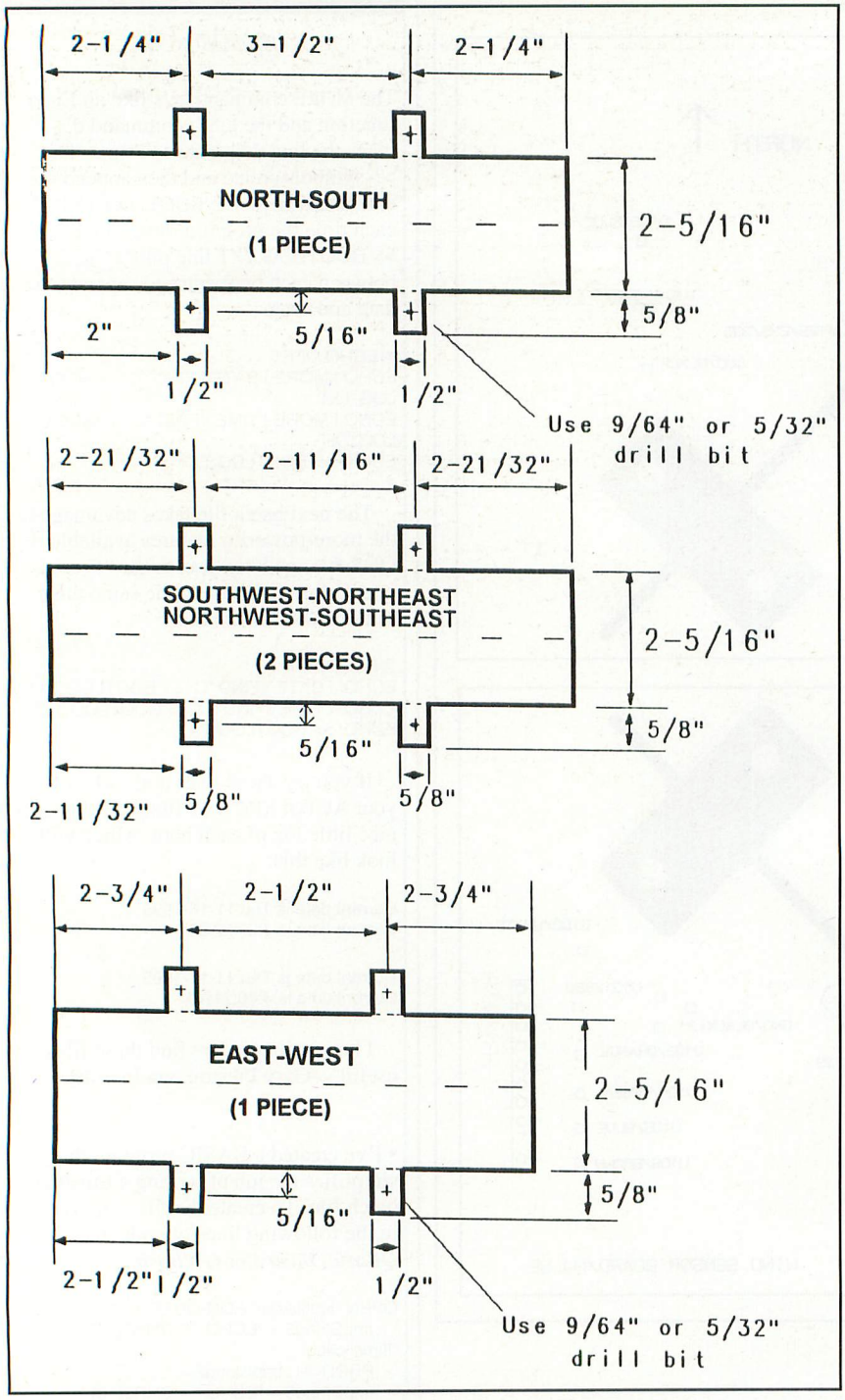


Fig. 5. Fabrication details for Sensor Board windbreaks.

(4) J-PORTB connector on MAGTROLL-11 to J-PORTB connector on the Display board.

The lengths of these cables depend upon the enclosure you use to house the Wind Vane.

You also need to connect a cable between the Sensor and Op-Amp Boards to bridge the J-SEN connectors. This cable must be quite long since you'll likely locate the sensor assembly on the roof of your home.

Finally, you need a two-conductor cable to connect *J1* on MAGTROLL-11 to the power supply. As the schematic indicates, if the power is supplied from a 7-to-12-volt dc source, connect the positive supply lead to pin 1 of *J1*. If the power supply is a regulated 5-volt dc unit, connect the positive lead to pin 3. In both cases, pin 4 connects to ground.

If you use an unregulated voltage for MAGTROLL-11, place a jumper at *JP1*. Because of the large amount of current used by the sensor assembly, it's important that you secure a good heat sink to the LM7805CTB voltage regulator on MAGTROLL-11. It would probably be smarter to power the system with a separate 5-volt dc regulated supply that's capable of delivering at least 250 mA.

If you use a 5-volt dc power source, make certain that no jumper is on *JP1* and that +5 volts connects to pin 3 of *J1*. Additionally, with a 5-volt dc source, reference voltage IC *U3* can't be used, which means that you must jumper pins 2 and 3 of *JP4*.

The Software

With the firmware for the Solid-State Wind Vane in the EEPROM inside the HCx11, you're restricted to either 512 or 2K (2,048) bytes, depending on the type of HCx11 you use. With such small storage spaces, you're limited to using assembly-language programming. Although the firmware used in the prototype consumes only about 512 bytes, it's still too long to show the entire source code here. However, the entire MOT S19 code is given in Listing 2.

A simplified flow chart of the software is given in Fig. 14. The following discussion is more detailed than the flow chart, which is only meant as a general guide for the program.

The first step is to set up the stack by loading the Stack Pointer at an appropriate place in RAM, set up NUMREAD by storing a number (say, 30) here and light the center LED for 0.5 second. After this, you input all eight temperatures from the sensors. Then you add the temperatures from each set of three adjacent sensor and divide the sum by 3.

The average temperature of this set of three sensors is stored at eight different word-sized (two-byte) variables, referred to as AN0MOD, AN1-MOD, on up to AN7MOD. The next routine determines if all ANxMOD temperatures are equal. If they are, the center LED on the Display Board lights for at least 0.5 second. This can occur, for example, if there's no wind or if there's a combination of exces-

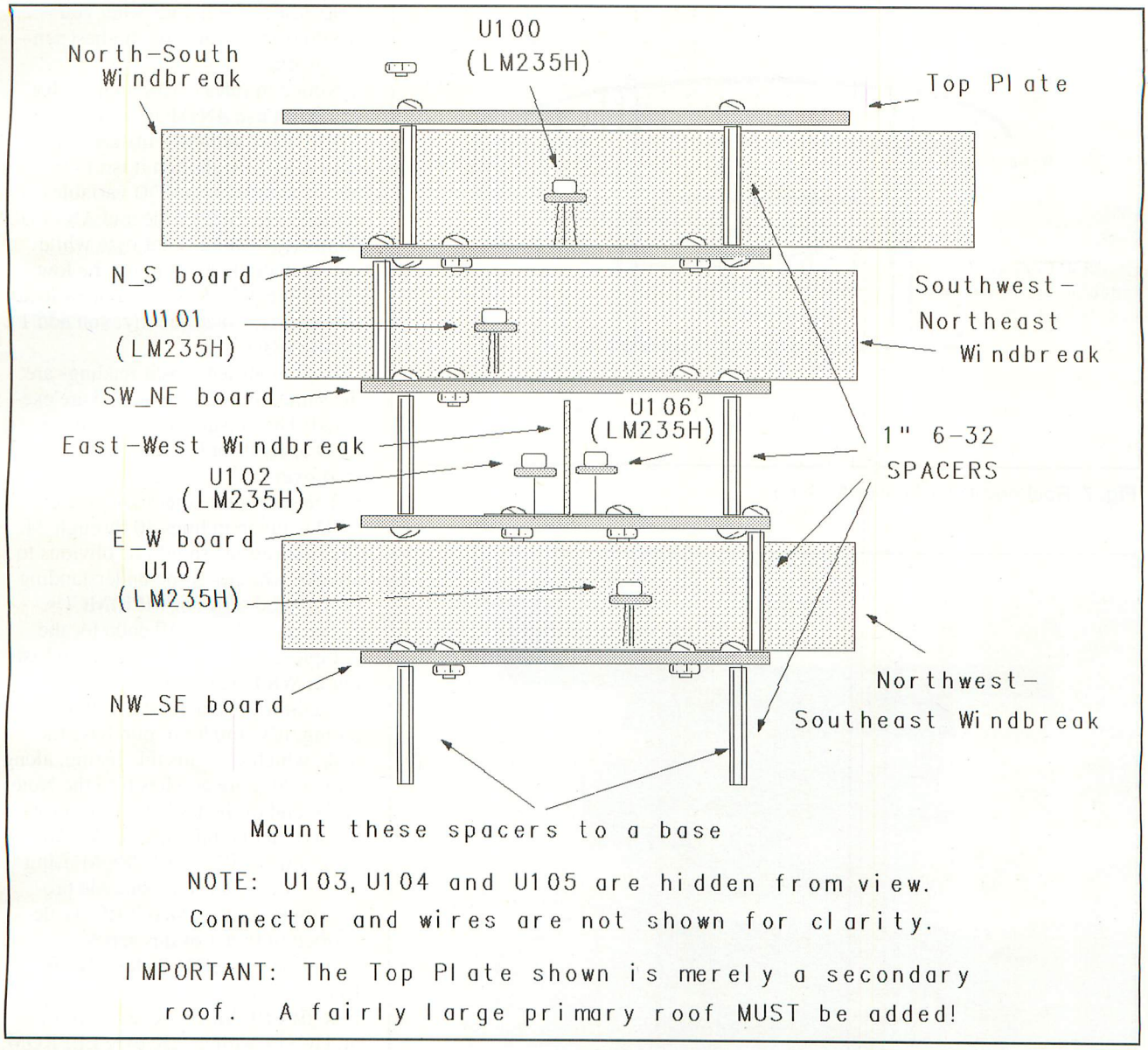


Fig. 6. Side view of Sensor Assembly.

sively high temperature (greater than 105° F) and only a very light wind.

If ANxMOD temperatures aren't all equal, the next step is to determine which is greatest. Once this is determined, the MCU, through PORT B, lights the LED that corresponds to the center sensor that makes up the three-sensor combination. For example, if the program determines that the average temperature of the North, Northeast and East sensors is greater than any other three-sensor average, the MCU sends a 06 Northeast signal via its PORT B to the Display Board, which, in turn, lights the Northeast LED. The program then branches back to the start, where it begins to take new sensor readings for an update.

Now for a brief look at a small portion of source code. For your convenience, instructions and assembler directives in Listing 1 are preceded by a line number and comments aren't.

Line 1 sets up the starting address for the program with the assembler's ORG directive. Notice that the starting address is $0B600. (The $ prefix means the number is hexadecimal, and the 0 prefix lets the assembler know that you're referring to a number and not a label.) This assumes that you're using the 512-byte EEPROM in the MC68HC11A1FN for your firmware. If you're using the 2K-byte EEPROM in the MC68HC811E2FN, this first line would likely be ORG $0F800. If a separate EPROM had been used, this starting address could be just about anything between 0 and $FF00.

Line 2 sets up the stack. The variable STACK was declared previously (not shown) in an RMB, or Reserve Memory Byte, directive.

Lines 3 through 6 set up the pseudo-vector for the illegal opcode trap. Now, if the program goes wild and the CPU detects an illegal opcode, things should calm down because the program will again start over at the beginning—just as if you pressed the RESET switch.

Lines 7 and 8 store 30 at NUMREAD.

Lines 9 and 10 light the center LED for 0.5 second, assuming a 4-MHz crystal and 1-MHz clock, to let

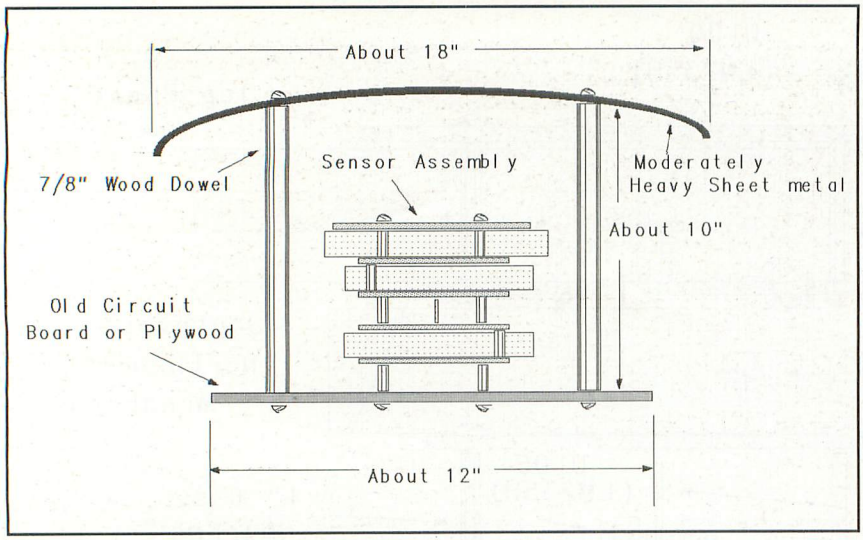


Fig. 7. Roof details for Sensor Assembly.

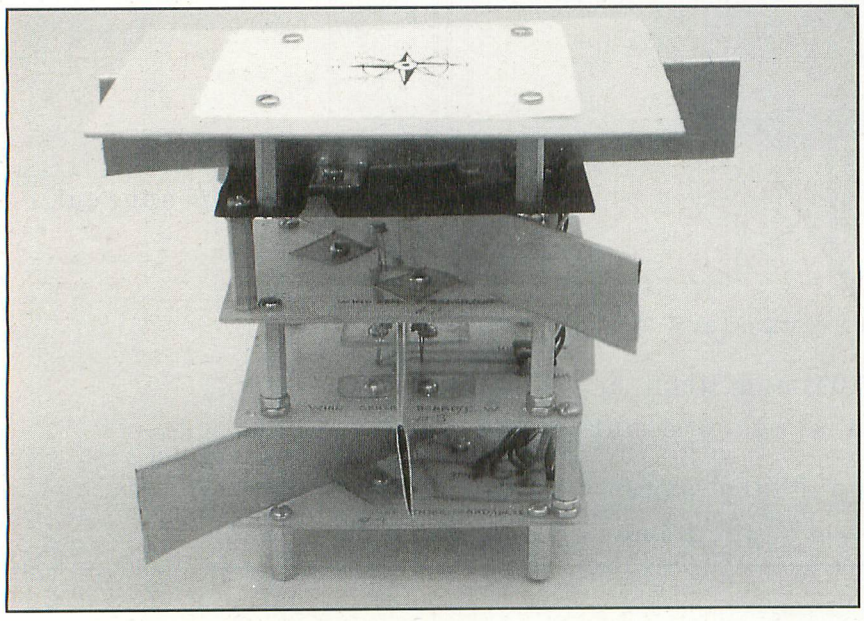


Fig. 8. Photo of completed Sensor Assembly.

you know that the MCU is operating correctly.

Line 11 calls the all-important TAKETEMP subroutine. This subroutine, which is too long and complicated to include here, initializes the A/D converter and takes the average of 30 readings (NUMREAD) of each sensor. Next, it takes the average reading of each set of three adjacent sensors and stores the result in ANxMOD. For instance, the first sensor (North) is initially stored at location AN0. This routine takes the average of AN7 (Northwest), AN0 and AN1 (Northeast) and stores it at AN0MOD.

Don't get confused with names here. In the software, AN0 is the temporary storage location for the data at the AN0 pin of the HCx11. While the names are identical, they actually refer to different entities—a storage location and a pin label. These separate entities have a 1:1 correspondence, however. (Perhaps, different names would help, perhaps not. Since the names refer to separate entities, they actually refer to the same basic element—the location that stores the data that's at the pin with the same name.)

Lines 12 through 26 merely check to see if all sensor (actually modified sensor) readings are the same. If they aren't, the program branches to FINDHIGH, which does what you would think—finds the highest sensor reading.

Notice in lines 12 through 26 that you don't use ANxMOD variables but ANxMOD+1 variables instead. The reason for this, though it isn't obvious, is simple. ANxMOD variables are actually two bytes wide and ANxMOD points to the high-order byte while you're actually looking for the low-order byte, which is one address location higher. Consequently, you add 1 to ANxMOD.

If all modified sensor readings are the same, lines 27, 28 and 29 are executed. This again causes the center LED to light for 0.5 second. You then start over.

The subroutine that lights the center LED is given in lines 30 through 34. This subroutine should be obvious to anyone who has some understanding of the 6800 series of MPU/MCUs.

The assembled .S19 code for the complete source code is given in Listing 2. While you can use an ASCII text editor to create a file with this listing, it's simpler to purchase the disk, which contains this listing, along with a lot more goodies (see the Note at the end of the Parts List for information on obtaining this disk). To program an HCx11 EEPROM using .S19 code, you need a suitable programmer, such as MAGPRO-11 described in Part 1 of this series.

As you can tell from the .S19 file in Listing 2, this program fills a 512-byte EEPROM. However, if you use an HC811 with its 2K-byte EEPROM, you can do more-sophisticated things, such as provide automatic sensor adjustment at power-up and routines where only an adjacent LED will be permitted to light, which will eliminate possible confusing flashing due to swirling wind. In addition, with an HC811 2K-byte EEPROM, it's possible to connect another display to MAGTROLL-11 and measure wind chill. Part 4 of this series will look at wind chill, as well as wind speed and temperature.

Software and MAGTROLL-11 Setup

Keep in mind that this project, like all projects that make use of a microcontroller, is based on software that resides someplace in silicon, referred to

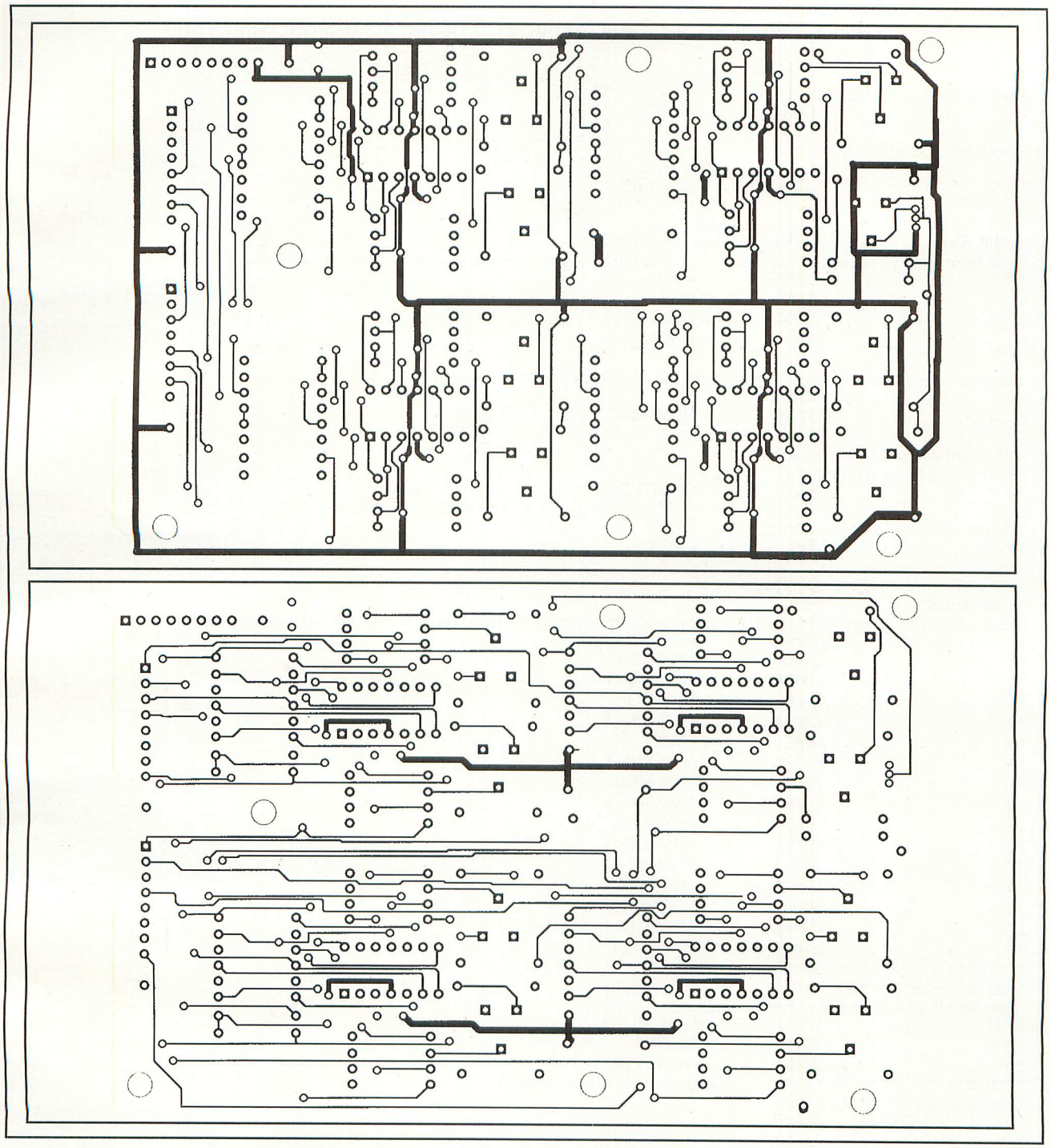


Fig. 9. Actual-size etching-and-drilling guides for Op-Amp Board.

as firmware. If you're using MAGTROLL-11 as your controller board, you *must* use an EEPROM-programmed HCx11.

You can program the HCx11 yourself with the .S19 code given in Listing 2 or from the PC-compatible disk mentioned in the Parts List. This disk also contains complete source code, a Motorola FreeWare HC11 cross-assembler and some other information. As indicated in the Parts List, a pre-programmed MC68HC11A1FN is available to get your Wind Vane up and running quick and easy and still be let you able to modify the firmware.

If you'll be using the Display Board described in this article, you must operate MAGTROLL-11 in single-chip or bootstrap mode. You must jumper *JP6*. (To operate in Expanded Multiplex mode, you must connect a custom-designed display board to PORT A and use an additional board that includes an address/data-line demultiplexer (usually a 74HC373 or 74HC573), along with address decoders and an EPROM.

If you're using an MC68HC11A1FN, you must set up MAGTROLL-11 for Bootstrap Mode. Jumper pins 2 and 3 of *JP5*, and jumper *JP2* for an automatic jump to internal EEPROM.

Listing 1. Program Segment for the MCU based Solid-State Wind Vane

```
*start of program is at $B600
1                       ORG             $0B600

*load stack pointer—very important

2                       LDS             #STACK

*setup the illegal opcode trap pseudo-vector
*which is located in RAM since we are using *the bootstrap mode
*now if something goes awry the program *will (hopefully) automatically start again *at the very beginning
3                       LDAA            #7EH
4                       STAA            0F7H
5                       LDD             #0B600H
6                       STD             0F8H

*set up to take 30 sensor readings each *time we go to the subroutine TAKETEMP
7       START           LDAA            #30
8                       STAA            NUMREAD

*first—light center LED so we know
*HCx11 is performing properly
9                       BSR             CENTRLED

*leave it on for 1/2 second—500 ms
10                      JSR             DLY500

*now check if ANxMOD temperatures
*are all equal
*if any are not equal branch to FINDHIGH *the program segment FINDHIGH will locate *the highest modified temperature
11      NEWCYCLE        JSR             TAKETEMP
12                      LDAA            AN0MOD+1
13                      CMPA            AN1MOD+1
14                      BNE             FINDHIGH
15                      CMPA            AN2MOD+1
16                      BNE             FINDHIGH
17                      CMPA            AN3MOD+1
18                      BNE             FINDHIGH
19                      CMPA            AN4MOD+1
20                      BNE             FINDHIGH
21                      CMPA            AN5MOD+1
22                      BNE             FINDHIGH
23                      CMPA            AN6MOD+1
24                      BNE             FINDHIGH
25                      CMPA            AN7MOD+1
26                      BNE             FINDHIGH
*if all ANxMOD temperatures are equal
*light center LED for 1/2 second
*then start over and take new measurements
27                      BSR             CENTRLED
28                      JSR             DLY500
29                      BRA             NEWCYCLE
**************************************** *subroutine CENTRLED lights the
*display board's center LED
30      CENTRLED        PSHB
31                      LDAB            #CENT_LED
32                      STAB            PORTB
33                      PULB
34                      RTS
****************************************
```

Your program must start at B600H and extend only to B7FFH at absolute maximum.

If you're using an MC68HC811-E2FN, jumper pins 1 and 2 of *JP5* and don't jumper *JP2*. Now, your program should start at F800H, and the last two bytes of memory space, at FFFEH and FFFFH, should contain F8H and 00H, respectively. This causes an automatic jump to F800H at reset. Also, store F800H at the address of the true Illegal Opcode trap vector at FFF8H and FFF9H. Don't worry about the pseudo-vector in RAM.

Since there's little need for RAM back-up for the Solid-State Wind Vane you can change super-capacitor *C7* on MAGTROLL-11 to a 0.1-µF value.

Initial Tests

Before installing the ICs in their sockets, connect power to MAGTROLL-11

Table 1. Potentiometer Adjustments

J-PORTE Pin Number	Adjust Potentiometer
1	Reference Pin*
2	R58
3	R9
4	R75
5	R43
6	R99
7	R39
8	R96

*No adjustment possible

and connect cables to J-MISCL connectors on the Op-Amp and Display Boards. Check voltages at all IC power pins. For instance, with the voltmeter's common lead connected to circuit ground, check the voltage at pin 4 of *U1* on the Op-Amp Board. It should be between 4.75 and 5.25 volts.

If all voltages appear correct, plug all ICs into their respective sockets. Exercise care to avoid static damage. With normal humidity, touching a good ground before touching an IC

Listing 2. WV_FINAL.S19 Program

```
S123B6008E0032867E97F7CCB600DDF8861E97888D2BBDB6FABDB704966591672627916 9E3
S123B62026239 16B261F916D261B916F2617917126139173260F8D05BDB6FA20D837C60890
S123B640F710043339966591672520916925 1C916B2518916D2514916F25109171250C9193
S123B6607325088607B710047EB6159667916925 18916B2514916D2510916F250C91712591
S123B6800891732504860620DC9669916B2514916D2510916F250C9171250891732504866F
S123B6A00520E4966B916D2510916F250C9171250891732504860420E8966D916F250C9165
S123B6C07125089173250486032 0EC966F9171250891732504860220DE9671917325048665
S123B6E00120D4860020D036B61030848027F932393CCE0D020926FD383937C6198DF25A7B
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S123B720D784D7857F0089333736965BB71030BDB6E7BDB6F1F61031E700087A008426EACC
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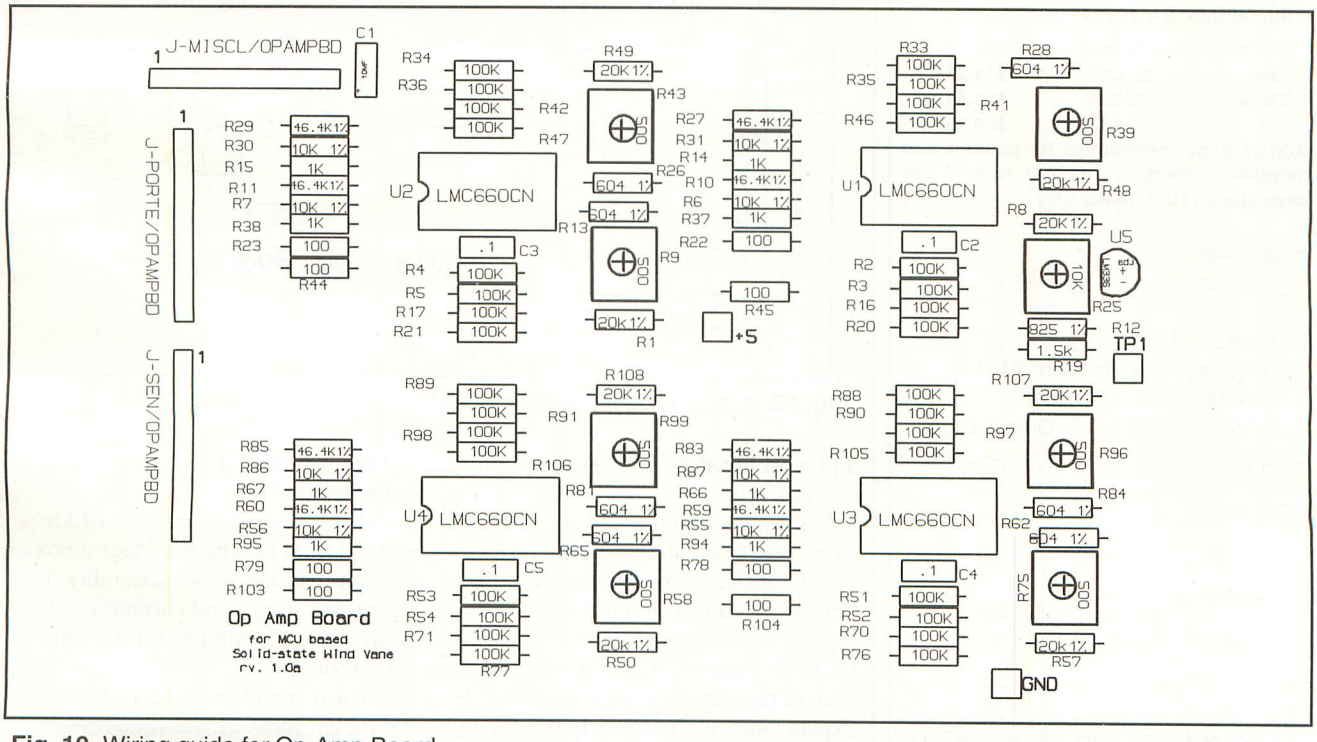
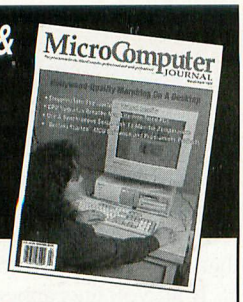


Fig. 10. Wiring guide for Op-Amp Board.

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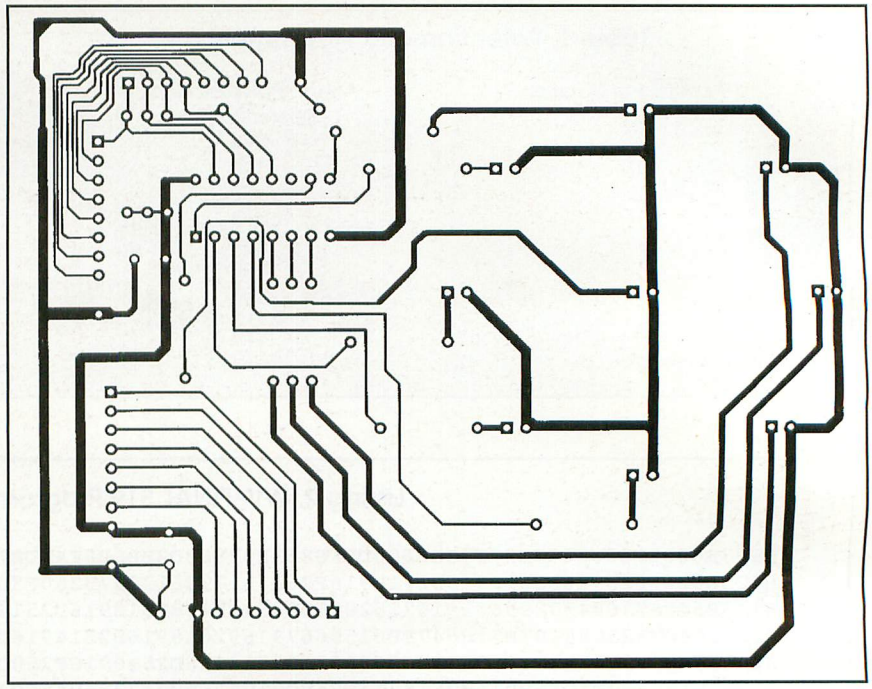


Fig. 11. Actual-size etching-and-drilling guide for Display Board.

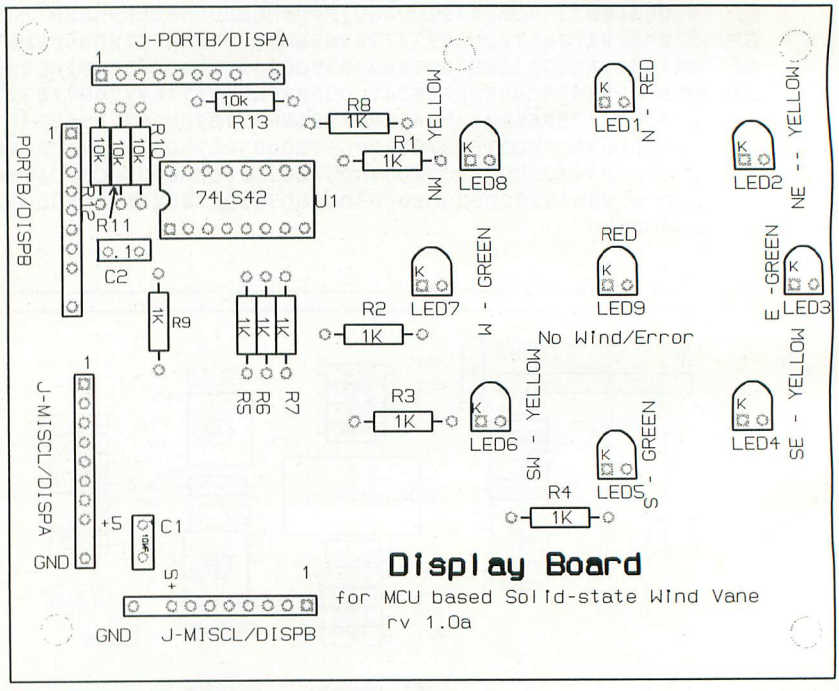


Fig. 12. Wiring guide for Display Board.

and working slowly is sufficient precaution.

Set jumpers on the MAGTROLL-11 as described above. Make sure you've installed a cable between the Sensor Assembly and the Op-Amp Board. Power up the system. The center LED should light for about a second. (This may be longer than you'd expect since it takes nearly 0.5 second to register the inputs of eight sensors 30 times each and do the necessary data manipulation.)

Next, one of the direction LEDs should light at random. Place a box or bucket over the sensor assembly (to eliminate stray wind currents) and wait at least 5 minutes for the sensors to stabilize.

Now using at least a 3½-digit digital meter, measure the voltage with respect to ground at *TP1*. If it isn't

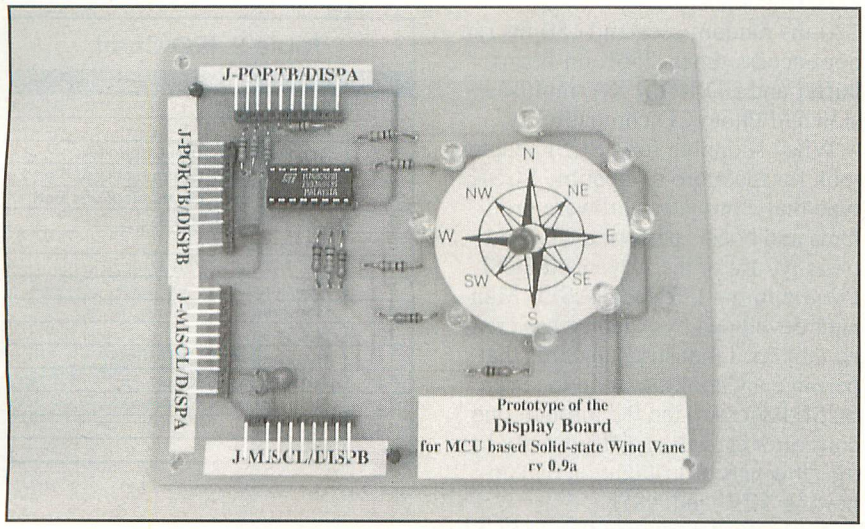


Fig. 13. Photo of completed Display Assembly.

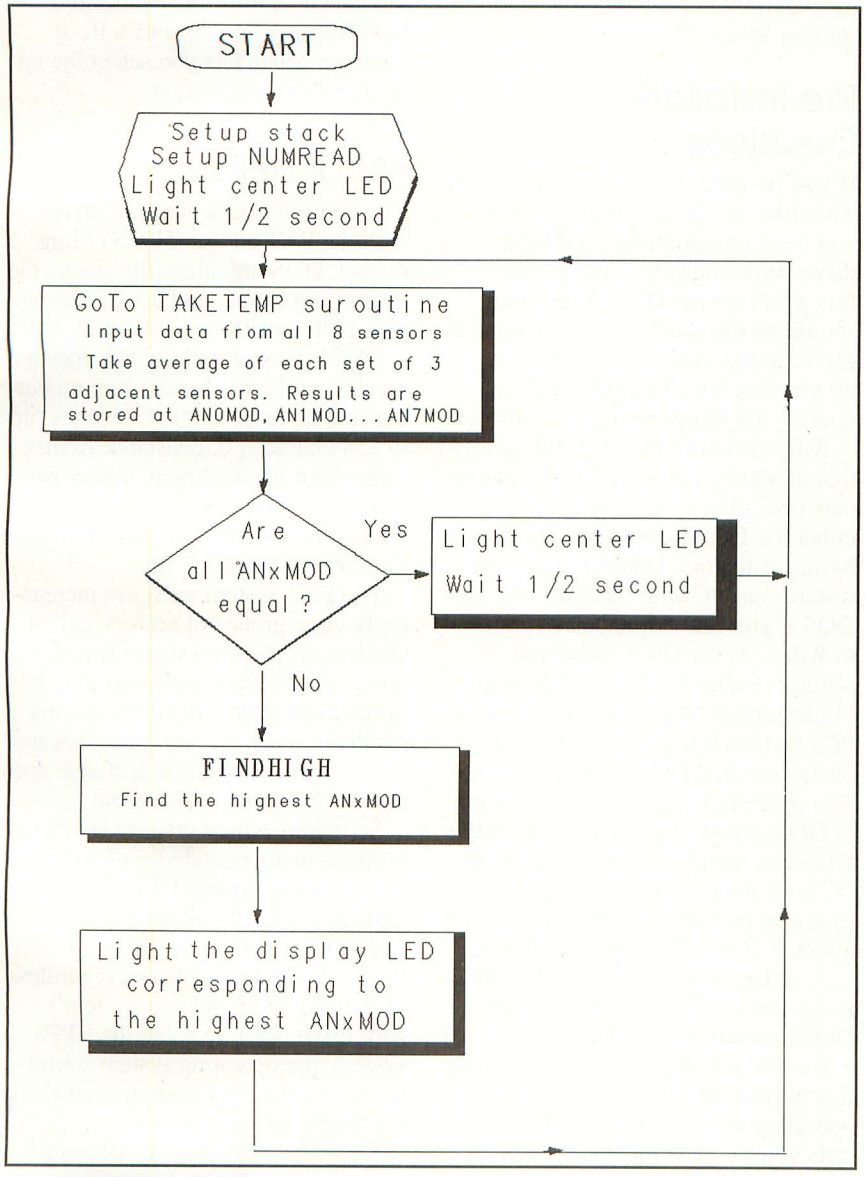


Fig. 14. Simplified software flowchart.

between 2.47 and 2.51 volts, adjust *R25* until it is. Next, measure the voltage at pin 1 of the J-PORTE connector on the Op-Amp Board. Since this will be the reference voltage, jot it down for later reference. Let's call this voltage V1.

Now, measure the voltage at pins 2 through 8 of connector J-PORTE and adjust the respective potentiometers so that these potentials are within 0.01 volt of V1 (see Table 1). After checking your adjustments, you might want to place a daub of an easily removable glue on the potentiometer trimmer screws to keep vibration from changing your adjustments.

Now use a fan to determine if the unit is working properly. Position the fan about 3 feet from the sensor assembly. Make sure the assembly isn't sitting on the floor or near a piece of furniture. It should be out in the open.

Direct the air current at the sensor from several directions to make sure it's working properly. It usually takes about 5 seconds for the display to respond to changes in direction. One pleasant, though surprising finding is that though the sensors take about 5 minutes to stabilize after being turned on, the Solid-State Wind Vane registers accurately within just a few seconds after being turned on. Thus, there's no need to leave the unit on continually, although it draws less than 1 watt of current, which adds up to less than $1 a year even if your electricity rates are obscenely high!

Due to aging of components, you might want to re-adjust the sensor potentiometers after several months of use. Since the sensor assembly will probably be in an awkward location to cover with a box, simply do re-adjustment before dawn on a day the wind is light and variable. ■

Other Companies Mentioned

Digi-Key Corp.
701 Brooks Ave. S.
PO Box 677
Thief River Falls, MN 56701-0677
Tel.: 1-800-344-4539

Mouser Electronics
National Circulation Center
2401 Hwy. 287 N.
Mansfield, TX 76063-4827
Tel.: 1-800-346-6873

stalling OS/2, the sound was fine, but I lost printing control. OS/2 uses and holds onto IRQ7 for all printing to LPT1. Even trying to use IRQ5 caused unstable problems because, even though I didn't use LPT2, OS/2 seemed to want to also keep it available.

Basically, OS/2 doesn't want to share interrupts or ports between hardware peripherals. I had to use IRQ10 before everything was working smoothly. With the Pro Audio Studio 16, I had to select IRQ15 to obtain stable operation.

Look for peripherals that offer as many interrupt-value choices as possible. Recently, there has been a lot of hype about Plug and Play peripherals. The new "plug-and-play" (PnP) technology must have a PnP BIOS on the PC motherboard to configure peripherals to non-conflicting values when connected to the computer. Table 2 serves as a guide to the unused interrupts available on 486 and Pentium PCs for motherboards that don't have a plug-and-play BIOS chip.

• ***CD-ROM Support.*** *Warp* takes full advantage of CD-ROM technology and is offered on CD-ROM for easy 15-to-30-minute installation. Without the CD-ROM, you're faced with 25 to 27 diskettes, with another 15 for the *BonusPak*, and more than an hour of disk swapping.

Installation of a CD-ROM drive has become more affordable and is a step you should seriously consider to bring your PC to state-of-the-art. Many PC vendors bundle a CD-ROM drive with their 486 and Pentium PC packages, and many software vendors market their products on less-expensive CD-ROMs for faster and easier installation.

Warp directly supports a wide variety of CD-ROM drives. The supported ones listed in Table 3 are supplemented by and many IDE-controlled drives. CD-ROM drives like the Toshiba TXM 3501 series ($495 to $595) are controlled by SCSI-2 protocol and offer the best flexibility, letting you daisychain up to seven SCSI devices (tape drives, hard drives, scanners, CD-ROM drives, SyQuest drives, etc.) from one controller card like the Adaptec 1542 ($200).

TXM 3501 quad-speed series CD-ROM drives exceed both Ultimedia and MPC 3 compliance with their 600K/s sustained transfer rate and 120-ms random-seek and 150-ms random-access times, 256K on-board buffer and CD-ROM XA, multisession and Photo CD compatibility.

When shopping for a SCSI adapter, look for the more-compatible SCSI-2 type that eliminates hardware problems and boosts performance. Additionally, use of the Advanced SCSI Programming Interface (ASPI) Manager developed by Adaptec has created universal industry standards that permit easy hook-up of up to seven SCSI devices to the PC through one controller card. *Warp* effortlessly handles this part of installation by supporting SCSI and ASPI.

Again third-party vendors of SCSI controller cards and CD-ROM drives controlled by proprietary cards should most definitely be avoided when installing *Warp*.

Pre-Installation Decisions

If you're using data-compression software like *Stacker* or DoubleSpace, you must un-compress your hard drive before installing *Warp*. Stac offers a *Stacker for OS/2* ($199) that should be installed later if you wish to use it. In any case, completely back-up your existing hard drive before starting the *Warp* installation process!

Warp installs a very helpful facility that gradually eases you into using the new operating system by installing either the Dual Boot and/or Boot Manager feature. Dual Boot lets you restart your PC with the more-familiar DOS if you find it difficult to get used to *Warp*. At the OS/2 command prompt (located in the OS/2 System Folder), type: BOOT /DOS to have your PC reset itself to run with the previously-installed DOS (and *Windows* 3.1) operating system. When running in DOS, type C:\OS2\BOOT /OS2 at the DOS command prompt to have your PC reset itself to run in OS/2. Each time you turn off your PC and then on again, it starts in whichever OS you were using last. Dual Boot is automatically installed on any PC that has DOS previously installed.

Boot Manager is an optional feature that permits installation of multiple operating systems on a PC and permits you to select the desired OS when you power up your PC . If you want Boot Manager, you need about a 1M partition for it and enough hard-drive space to re-partition your drive for each operating system desired. Upon turning on your PC, a Boot Manager Menu lets you select the operating system you want.

Table 2. IRQ Chart

IRQ	Associated Device
0	System Timer
1	Keyboard
2	Secondary Interrupt Controller
3	COM2 (Serial Communications Port 2)
4	COM1 (Serial Communications Port 1)
5	LPT2 (Parallel Port 2)
6	Diskette
7	LPT1 (Parallel Port 1)
8	Realtime Clock
9	Not Used
10	Not Used
11	Not Used
12	Auxiliary Port (Mouse)
13	Math Coprocessor
14	Hard Disk
15	Not Used

FAT or HPFS

You can reformat your hard drive with the FAT and/or (HPFS) filing format. DOS organizes files using the FAT filing format and doesn't recognize HPFS available with OS/2. HPFS is OS/2's way of making file management flexible. It's benefits are numerous and include: longer filenames (up to 254 characters); resistance to disk fragmentation, leading to higher performance (five to ten times faster than FAT); and easy reading and writing of traditional DOS FAT files.

The FAT system must use increasingly large groups of sectors, called clusters, as partition sizes grow. Since today's hard-drive partitions may be upwards of 300M to gigabytes, this results in much wasted space, because an average of half of each cluster goes unused using the FAT system.

Switching a hard drive to HPFS can produce many megabytes of additional free storage space. HPFS always allocates space based on physical 512-byte sectors, rather than on FAT's 1,024-byte clusters, regardless of partition size. When a system's hard drive is set up using the HPFS system, the operating system continues to use the FAT system exclusively for floppy disks.

Since the HPFS system takes up approximately 500K of system memory, it requires a minimum of 6M of

Table 3. CD-ROM Drives Supported by OS/2 *Warp*

Manufacturer	Model
CD Technology	T3301, 3401
Chinon	431, 435, 535
Compaq	Dual Speed
Creative Labs	OmniCD
Hitachi	CDR1650S, 1750S, 1950S, 3650, 3750 and 6750
IBM	CD-ROM I, II, enhanced II and ISA CD-ROM
Mitsumi	CRMC-LU002S, 005S, FX001, 001D, 001DE
NEC	Intersect 25, 36, 37, 72, 73, 74, 82, 83, 84, Multispin 4Xe, 4Xi, 3Xe, 3Xi, 3Xp, 38, 74-1, 84-1
Panasonic	CR-501, LK-MC501S, 521, 522, 523, 562 and 563
Philips	LMS CM-205, 205MS, 206, 207, 215, 225MS and 226
Pioneer	DRM-600 and 604X
Plextor	DM-3028, 5028 and 4PLEX
Sony	CDU-31A, 33A, 55E, 541, 561, 6111, 6211, 6251, 7201, 7205, 7211, 7305, 7405, 7811
Texel	DM-3021, 3024, 3028, 5021, 5024 and 5028
Toshiba	XM-3201, 3301, 3401, 3501 and 4101
Wearnes	CDD-120

RAM and 60M or more of hard-drive space. If you're using a greater than 120M drive, HPFS is a better choice for managing it. In either case, with OS/2, both HPFS and FAT read ahead (for sequential I/O), "lazy write" to disk and accept threshold parameters. So even if you don't have the 6M of RAM required for HPFS, OS/2 will still run FAT files faster.

You can add the HPFS option to your system later, using the Selective Install utility program in the System Setup folder.

Installing *Warp*

You'll have an easier task if you first decide on and get together every piece of hardware for your system before starting installation. Adding hardware to an existing *Warp* system can be frustrating and may lead to re-installing the OS (a good reason for obtaining the CD-ROM version). Decisions should be considered as to the use of Dual Boot, Boot Manager, FAT or HPFS features.

Installation consists of two phases and begins by simply placing the *Warp* Installation Disk in drive A: and turning on your PC. The Installation Disk boots up your PC and prepares it for *Warp*. If you're using the CD-ROM version, place the CD-ROM in the drive and the Installation Disk in drive A: before start-up.

Phase One is character-based and involves choosing Easy or Advanced Installation. *Warp* will attempt to inventory and identify all the hardware components of your system. Phase Two is a graphical portion that enables the choice of the components and utilities that will customize the operating system to your PC and needs.

All versions of *Warp*, including the CD-ROM, are shipped on 3½" floppy disks. If drive A: uses a 5¼" floppy, you must switch floppy-drive cables so that the 3¼" floppy drive will be drive A:. Don't forget to change your CMOS setup when you start up your PC after you change the cable hook-up.

The CD-ROM version makes *Warp* installation a bit easier. All you do is download w5crdr.zip from Compuserve's IBM OS/2 Support Forum (go ibmos2) and search the library section for w5crdr.zip or w5drdr.zip if you have a 5¼" drive A:. You also need the PKUNZIP decompression utility (available in PKWare's PKZIP.EXE Version 2.04g from any on-line service) to unzip the files. The file will create 5¼" disks you can use to install OS/2 from a CD-ROM on a PC that has only a 5¼" drive A:.

Use Easy Installation to install *Warp* with the preselected settings based on your current hardware and software. Easy Installation sets up the operating system on the same hard-drive partition that has DOS and *Windows*. It uses the FAT file system and installs all the documentation; system fonts; optional system utilities; tools and games; OS/2-DOS support; OS/2-WIN support; multimedia support (if multimedia hardware is detected); REXX; optional bitmaps; and Advanced Power Management and PCMCIA (if capabilities are detected). Choosing this installation requires 60M to 70M of hard-drive space.

Choose Advanced Installation only if you consider you're an experienced PC user. In Phase One, the Advanced Installation decisions are concerned with installing Dual Boot and/or Boot Manager; changing the disk partition where *Warp* is to be installed; and choosing the format of the disk partition (FAT or HPFS). You can perform Advanced Installation later, but it requires that you re-partition and reformat your hard drive, as well as backing up all the files you want to preserve.

Advanced Installation lets you install *Warp* on a PC that has no previous operating system on it; install *Warp* on a logical, instead of a primary, partition or drive; and select specific software features of *Warp* instead of the pre-selected group noted in the Easy Installation procedure.

Phase Two starts with a series of System Configuration screens that query you for confirmation of all hardware in your PC. Confirm all the devices and their configurations noted on the screens. You can change any of the system, locale or peripheral devices from an on-line list to correct any errors or additions. You can call up this window at a later time to add new peripherals through the Selective Install folder in the OS/2 System object.

Next, the OS/2 Setup and Installation screen lets you select the software features you wish to install with *Warp*. After each choice is an indication of the hard-drive space required. Throughout installation, a Disk Space window in the lower-right corner keeps a running total of available hard-drive space versus required space for the selected features to be installed.

If you're using floppy disks, you're prompted at the appropriate times to swap each of the 20 to 27 of them. If you're installing OS/2 *Warp* without WIN-OS/2 and want *Windows* 3.1 compatibility, have handy the original *Windows* 3.1 Installation Disks. The CD-ROM loads the installation continually—unless you're installing *Warp* without WIN-OS/2, in which case, you still need the original *Windows* 3.1 disks.

Once you've installed all features,

Warp migrates your DOS and *Windows* programs to the OS/2 Desktop. You can repeat the migrate procedure anytime through the System Setup folder, in the OS/2 System object (icon), whenever you want to install a new DOS or *Windows* program onto the Desktop of the Workplace Shell.

A Selective Uninstall utility in the System Setup folder lets you remove any part of *Warp* that's no longer being used to free up hard-drive space.

Once everything is in place, power down and restart your PC. When your PC starts for the first time after installation, you're immediately placed in the OS/2 Tutorial. The Tutorial and an Information folder are always available on your Desktop to help with any questions you may have concerning using and customizing the Workplace Shell Desktop.

All OS/2, as well as *Windows*, programs have readily available context-sensitive help. After leaving the tutorial, you'll notice an arrangement of objects on the OS/2 Workplace Shell Desktop. These represent items or folders (applications or files attached to applications) in the Desktop environment and are displayed as icons or small graphical representations.

Upon installing the *BonusPak*, you begin to actively use the OS/2 operating system. From the OS/2 Desktop, open the OS/2 System object and then Command Prompts and choose either the OS/2 Full Screen or OS/2 Window icon. Place the first disk in drive A: and type A:INSTALL at the command prompt. Select the *BonusPak* programs you wish to install and click on the INSTALL button. Then follow the on-screen instructions and stand by to swap floppies.

CD-ROM users simply follow the above. Select drive D: (or whatever the letter designation of your CD-ROM drive), and type D:INSTALL. Select the programs you desire, and then click on the INSTALL button. The whole OS/2 and *BonusPak* installation process should take a little more than an hour, faster if you use the CD-ROM version, provided you're using hardware that's directly supported by *Warp*.

• ***Shut Down Before Turning Off.*** To leave *Warp*, don't just power down your PC when you're through with an application or see the C: prompt, as you do with a DOS or *Windows* PC. You must access a Shutdown command from the Desktop pop-up menu through a right-button mouse click anywhere on the OS/2 Workplace Shell Desktop or OS/2 LaunchPad. This ensures that the file system "lazy write cache" is empty and causes the Workplace Shell to close all open applications; to save information such as the size and position of folder windows and icons and lists of applications that are currently running. This saves your work and Desktop configuration. The next time you power up, everything goes back to where you left it.

Turning off power without Shutdown, or in the middle of any *Warp* session, may damage the PC's initialization files and corrupt the Workplace Shell Desktop. This could result in the loading of a previously auto-saved initialization file and Desktop configuration.

• ***Fine-Tuning.*** Application programs, files and data files on *Warp*'s OS/2 Workplace Shell Desktop are represented as an object or folder and can be fine-tuned by just a point and right-button mouse click. An object's or folder's right-button pop-up menu gives all the options available for the object. The Properties item from an object's pop-up menu displays a dialog box that has eight tabbed pages of tuning options.

It's essential that the hardware and operating system be in sync. Use of memory management and swapping, file management, print spooling and disk caches are all factors to operate *Warp* efficiently. Clear & Simple's *Performance Plus* Version 3 ($39.95) disk helps optimize *Warp* installation to produce maximum performance from your PC by running system diagnostics.

Once you've run the diagnostics, an Optimizer places all of the performance-oriented CONFIG.SYS parameters on a single-screen GUI. Recommendations vary by resources and the version of OS/2 running. Every field on the GUI represents a parameter in the CONFIG.SYS file and has a help panel associated with it. All values are checked for validity as you choose to change them. A click of a button Sets the Optimizer recommendations to automatically fine-tune the *Warp* setup on your PC for optimum performance.

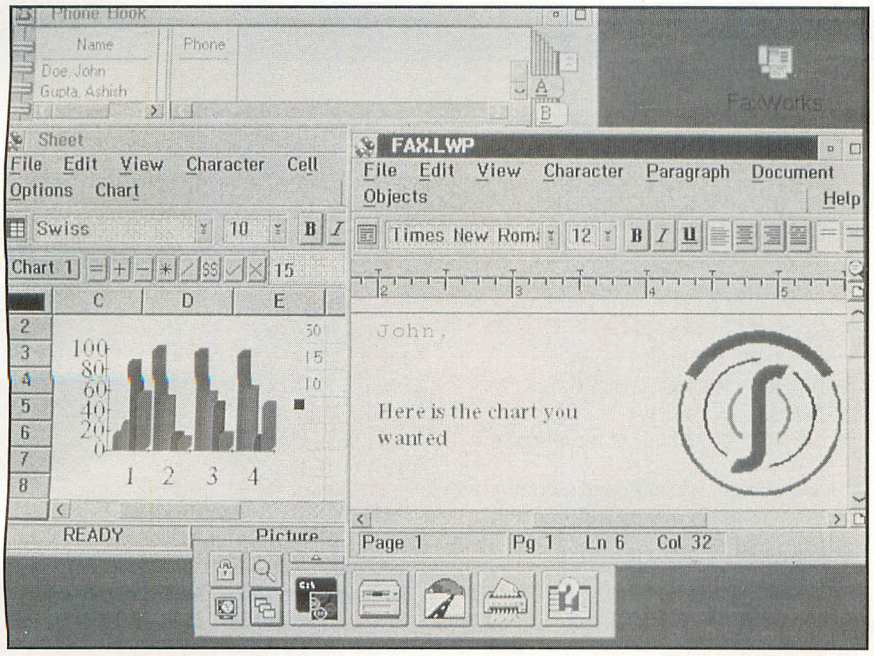
Performance Plus contains many other helpful utility programs for effectively using *Warp*, such as a DOS Black Box that optimizes any DOS or *Windows* applications in a drag-and-drop exercise; OS/2 Boot that creates a single emergency OS/2 boot disk or emergency boot partition and a second utility disk that contains CHKDSK, FORMAT, ATTRIB, FDISK and TEDIT (Warp's tiny editor); viewing and monitoring performance statistics and swap-file growth; and a disk packed with *Warp* bitmaps. Easy-to-understand prompts and dialogs explain the various *Warp* setting parameters, and a well-written program manual provides a nice education on *Warp* while tuning your setup.

• ***Back Up Your System.*** Once you've set up *Warp* and are satisfied it works with all your peripherals and applications, you should create a back-up of the entire setup to protect it from hardware and software disasters. The System Settings folder has a Special Utility Creation Tool that creates a set of *Warp* boot disks for starting and diagnosing a faulty system. Key diagnostic programs, like CHKDSK, are placed on these disks as part of the creation process. So even if your *Warp* system won't boot, you'll still be able to access and repair it—including HPFS partitions—using the utility boot disks.

As a further safety net, a tape back-up of the entire hard-drive system is easier to deal with than to sit for hours feeding floppy disks and then having

Table 4. SCSI Adapters Supported by OS/2 *Warp*

Manufacturer	Model
Adaptec	AHA 1510/1520/1522, AHA1540/1542, AHA 1640, AHA 1740/1742/1744, 2840VL/2842VL/2740/2642/AIC7770, 2940/2940W/AIC7870
BusLogic	BusMaster SCSI; DPT PM2011/2012
Future Domain	TMC-845/850/860/875/885, 9C50/C950, 1650, 1790, 1795, 1800/18C30/18C50, 3260/36C70, MCS600/700,7000EX
MediaVison	ProAudio Spectrum 16 with Trantor SCSI
IBM	Any SCSI Adapter



Screen shot shows some of the applications in the *BonusPak*.

to store them. IBM, Irwin, HP/Colorado Jumbo and Trakker and Mountain tape drives are supported through OS/2 back-up software like Hewlett Packard/Colorado *OS/2 Backup* ($69.95) or MSR Development's *BackMaster for OS/2* ($89.95).

HP/Colorado's *OS/2 Backup* handles extended attributes, long file names, .INI files and the OS/2 Desktop. It will backup FAT, HPFS and stacked FAT partitions. It supports bidirectional data exchange between DOS, *Windows* and OS/2 and features a two-disk disaster-recovery utility to restore a destroyed system. It also supports HP/Colorado Jumbo (internal floppy-controlled) and Trakker (external parallel-port-controlled) 120, 250 and 350 tape drives and HP/Colorado FC-10/20 and TC-15 tape-drive accelerator cards. An update is due soon to handle the larger tape back-up drives now available.

MRS Development's *BackMaster for OS/2* Version 2.0 is a 32-bit OS/2 tape back-up program for HPFS, FAT and stacked-FAT file systems. It supports both SCSI- and floppy-interface tape drives and provides many storage-capacity (120M to 8G) and data-cartridge (Travan, QICWide, QIC and SCSI DAT) choices. Floppy-interface tape drives from Archive, Backmaster, HP/Colorado Jumbo, Conner, CoreTape, Iomega Ditto, Mountain FailSafe and Summit are fully supported, as are parallel-port tape drives from AugmentX Retriever, Backmaster, HP/Colorado Trakker, Conner, Iomega Ditto, MicroSolutions BackPack and Tecmar. *BackMaster* also enables HP/Colorado Jumbo and Trakker 250 tape drives to store up to 350M using DC2120XL tapes.

There's also direct support for tape-drive accelerators like BackMaster Tape Accelerator II, HP/Colorado FC-10/20 or TC-15, Iomega Tape Accelerator and the generic 2.88M floppy controller. An enhanced feature includes a boot-from-floppy restore utility for rapid restart and recovery of the OS and provides command-line options, drag-and-drop launch and custom file-save sets.

BonusPak Applets

Perhaps IBM's best improvement for OS/2 is the enhancement of the applet package included in *Warp*'s *BonusPak*. This is a collection of Workplace Shell-aware, SOM-enabled applications that get you started fast doing productive work using *IBM Works* and *FaxWorks for OS/2*; inclusion of *Person to Person for OS/2*, *Multimedia Viewer* and *Ultimedia Video IN for OS/2* and the SYSINFO tool make it easier to communicate ideas and peek inside the OS/2 operating system; and on-ramps to the much-hyped Information Superhighway—CompuServe *Information Manager for OS/2*, *HyperACCESS Lite* and the IBM *Internet Connection for OS/2*.

Included in the *IBM Works* suite is a full-featured word processor with a spell checker, spreadsheet and charting program, database, report writer and a personal-information manager (PIM). All *IBM Works* applications are SOM-enabled and integrate seamlessly with the Workplace Shell desktop.

FaxWorks for OS/2 is a full-featured fax application that offers send/receive capabilities, integrated fax transmission log and speedy viewer for examining and printing received faxes. The program permits any OS/2, *Windows* or DOS application to send faxes simply by using the print command. You can send Faxes in the background from *Windows* or DOS applications when they're running under OS/2.

The package supports most fax modems that are available today, including Class 1 and Class 2. The program supports Adobe Type Manager and TrueType fonts and features image editing, an auto-print feature to direct incoming faxes to your printer, unlimited telephone books, customized coversheets, annotation tools, unattended fax broadcasting and Optical Character Recognition (OCR).

To help people better communicate in the new mobile workplace, *BonusPak* includes, *Person to Person for OS/2* realtime desktop video-conferencing. *Person to Person* lets multiple network users share a single virtual drawing board to present ideas, highlight data and instruct each other on the workings of a particular application.

There are tools for working with full-motion video, a simple chat utility and address book for maintaining a list of target *Person to Person* systems. While *Warp* provides the software for video-conferencing, it doesn't provide the hardware—modems, high-speed ISDN lines, cards and cameras and other necessities.

Multimedia Viewer supports Eastman Kodak's Photo CD format and makes working with multimedia data easier by creating a virtual "light-table" environment that displays thumbnail images of various multime-

Sources

Hardware

SCSI-2 Controllers
Adaptec Corp.
691 S. Milpitas Blvd.
Milpitas, CA 95035
Tel.: 800-959-7274 or 408-945-8600

CIRCLE NO. 207 ON FREE INFORMATION CARD

Future Domain Corp.
An Adaptec Company
2801 McGaw Ave.
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Irvine, CA 92713-9724
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Washington, D.C. 20036-4510
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2150 N. First St., Ste. 440
San Jose, CA 95131-2020
Tel.: 408-435-0333

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dia data objects. The *BonusPak* CD (with *Warp* CD-ROM version) comes with a number of sample images, as well as *Animator* and .AVI files. *Ultimedia Video IN for OS/2* works in conjunction with another *Warp* OS enhancement: Win-TV support. Win-TV lets you view TV signals, while *Video IN* can capture these images, along with bitmaps and other clipboard data, to disk for later editing.

SYSINFO looks inside the *Warp* system by providing important information about I/O adapter settings, system-memory configuration, mass-storage device statistics, etc. This tool helps diagnose system errors and aids in fine-tuning performance by offering an accurate assessment of the installed hardware and software configurations.

CompuServe *Information Manager for OS/2* is a 32-bit multithreaded version of the popular CIM front-end currently available to DOS and *Windows* users. This offers excellent multitasking performance for background file transfers and message downloads form CompuServe.

HyperACCESS Lite for OS/2 offers 32-bit asynchronous terminal emulation that features a number of file-transfer protocols, among them HyperProtocol, Xmodem, CompuServe B and Zmodem, and can automatically detect appropriate terminal emulation upon connection. A new enhanced full version of *HyperACCESS for OS/2* is available for $129.

When *Warp* was announced to the public, it was advertised as "Your on-ramp to the information superhighway" because it was the first PC operating system to offer single-click access to the Internet. *IBM Internet Connection for OS/2* provides a complete suite of Internet tools that access this extensive on-line resource. These include TCP/IP, SLIP (Serial Line Internet Protocol) and Point to Point Protocol (PPP) support; Workplace Shell-based Telnet, FTP and Gopher utilities; *OS/2 Ultimedia Mail/2 Lite* electronic mail; and an Internet dialer for tying into the IBM Global Network service. An additional utility, the IBM WebExplorer, is included in current packages of OS/2 *Warp*.

If you find that your OS/2 *Warp* Upgrade doesn't contain WebExplorer in the *BonusPak*, you can automatically download it from the IBM Glob-

al Network by clicking on the "Retrieve Software Updates" icon in the Internet Connection for OS/2 folder.

To get on the Internet, you must first select a service provider that gives you access to its computer for connection to the Internet. The Internet Connection for OS/2 folder automatically connects you with the IBM Global Network Service Provider through more that 450 local telephone numbers. There's an initial $19.95 set-up charge, and then you can choose a $29.95/month charge that gives you 30 hours/month use of the Internet with a $2/hour charge if you exceed the 30-hour monthly allowance. You can choose the $12.95/ month charge, which gives you 6 hours/month access to the Internet with a $2.50/hour charge beyond the allowance. Initially, you get a 10-hour trial period before any charges are started. Available is 800-number access, which adds $6/hour to the hook-up charges.

Another option for a service provider is to access the Internet through one of the 45,000 local telephone numbers already in use by more than 3-million members of CompuServe, which charges $9.95/month for five hours/month access with a $2.95/hour charge after the initial five hours. A $24.95 Super Value Club charge offers 15 hours/month with a $1.95/hour charge beyond the 15 hours.

To access the Internet through CompuServe, you must download CompuServe NetLauncher software and PPP update located in the OS/2 Users Forum in Internet Scripts library with the filename PPP.zip. *BonusPak*'s Internet Access Kit must be installed on your PC. After unzipping the file and installing the PPP update, open the Dial Other Internet Providers object in the Internet Utilities folder. Choose the Add Entry object, or select Add Entry from the Configure pull-down menu. Then configure the dialer as instructed in the readme file included with the Netlauncher software.

Support is Everywhere

IBM includes a readable manual that, when added to all the on-line help files, offers two great sources for learning how to use and customize the OS/2 *Warp* Desktop. *Warp* customers get 60 days free service directly from: IBM by dialing 800-992-4777; on-line services like CompuServe Information Service (CIS), TALKLink and Prodigy; the Internet through IBM Global Network available 24 hours daily, seven days a week; and hardware and software vendor BBSes for assistance with installation, application and hardware problems.

Joining the IBM Global Network permits you to update *Warp* system files directly to your PC. IBM maintains extensive OS/2 on-line support through forums and software libraries on CIS (GO OS2SUP or GO OS2-USER) and Prodigy (JUMP OS/2-CLUB).

For information concerning registration and access to IBM's own OS/2 BBS, call 800-547-1283. For CIS membership information, call 800-848-8990. For Prodigy membership information, call 800-776-3449.

Since OS/2 *Warp* 3.0 appeared, many books have been published to help both *Warp* beginners and experts. I use *OS/2 Warp Unleashed* ($39.95) published by SAMS Publishing (tel.: 800-428-5331). It's contains helpful hints and tricks that greatly eased any difficulties I encountered. This book also comes with a CD-ROM that's loaded with samples of 32-bit *Warp* applications. There's also *OS/2 Warp For Dummies* ($19.95), available from IDG Books (tel.: 800-762-2974). If these should fail to help, feel free to contact me on CIS: #71241,3031 or Internet: 71241.3031@compuserve.com, and I'll try to give you some suggestions.

In Closing

I was pleasantly surprised at how easy and fast *Warp* installed on my systems, one a reasonably-equipped desktop 486 and the other a minimal laptop PC. As a computer writer/consultant, I frequently try out or install new software and hardware products. New DOS, *Windows* and OS/2 application software install onto the OS/2 Desktop using the same commands as in DOS and *Windows*, with great ease. Open up a DOS or *Windows* (WIN-OS/2) window and install the new DOS or *Windows* application as you would on a DOS or *Windows* PC. You then migrate it onto the OS/2 Workplace Shell Desktop. With OS/2 native applications, double-click the drive icon and then on the application's install program, and the application installs itself onto the Workplace Shell Desktop.

Once you've set up *Warp*, installing new hardware can be a bit tricky. I don't recommend it for non-technical users. There have been times I've had to re-install *Warp* or parts of it. I was pleased to find that, in most cases, the Workplace Shell Desktop usually came back the way I left it before re-installation.

Warp also seems to be a "smart" operating system. If something does go wrong and you have to leave an application, when you shut down and start up again, it resolves the conflict or problem and puts you back on-track.

Clients who have installed *Warp* on their PCs are taking advantage of its multitasking and multithreading capacities to increase productivity. Those who have taken the time to learn *Warp* have found its object-oriented drag-and-drop and powerful customizing features very useful and easy to learn. What seem to be their favorite features are the speed at which their DOS programs run and the stability of *Warp*. Another favorite is the ability to recover from any crashes or near-crashes, without having to hit Ctrl-Alt-Del or pulling the plug on the machine.

If you're looking for your 486 or Pentium PC to do more and make use of its designed power, *Warp* is certainly a well-tested and proven OS. Stepping up from *Windows* 3.1 to *Warp* isn't very difficult or expensive using the Red label version on CD-ROM. Your *Windows* 3.1 setups will then sit on a much more-powerful, stable and productive operating system. DOS users will make their lives and fingers more relaxed using the object-oriented drag-and-drop command structure instead of DOS's character-oriented keyboard commands.

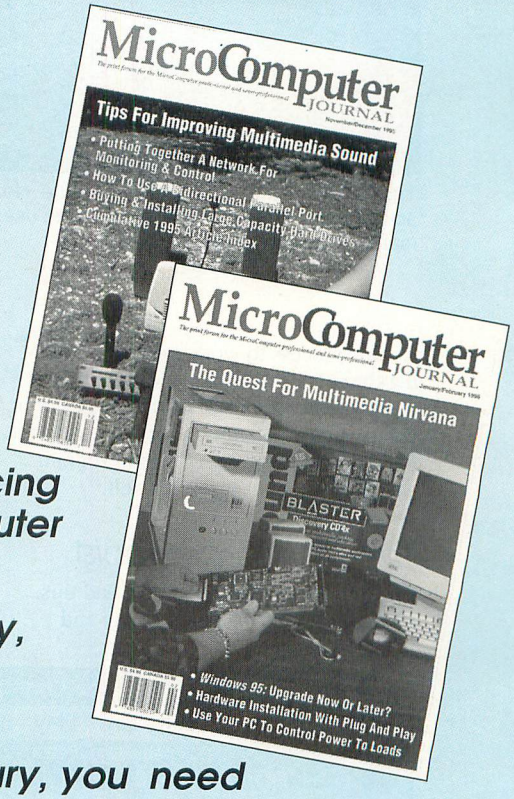
In the space that occupies DOS, *Windows*, memory manager, print spooler, disk cache and utility software, you can put in place OS/2 *Warp* 3.0 that will do it all and add multitasking and multithreading to your desktop or laptop PC. The investment in *Warp* will turn your PC into as many virtual DOS machines as your applications require. IBM's OS/2 *Warp* 3.0 will ease you into the world of true multitasking and multithreading applications and the future of object-oriented desktop microcomputing.

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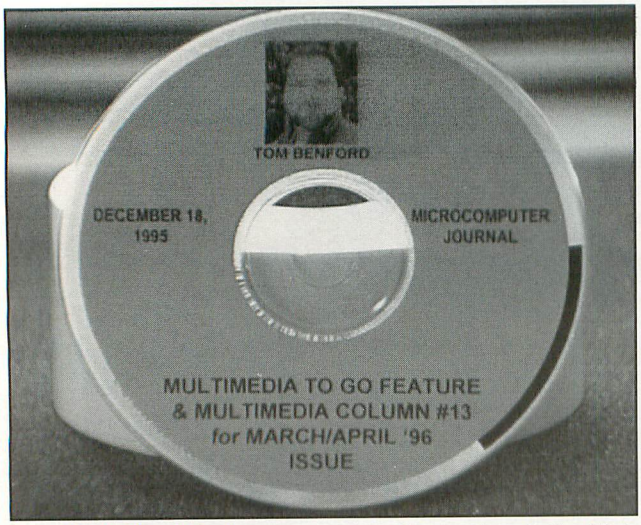
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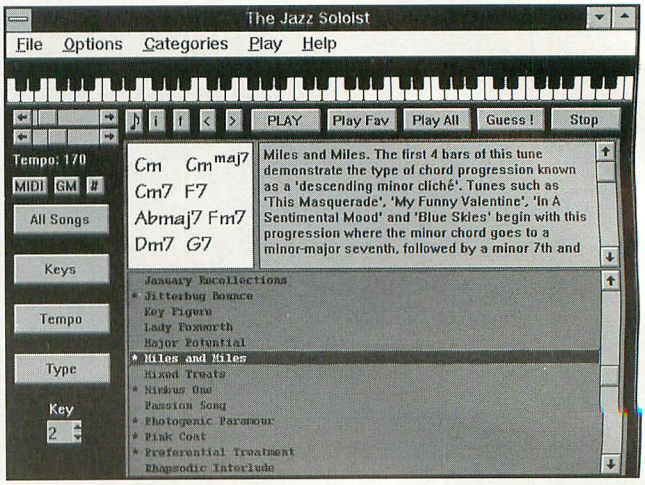
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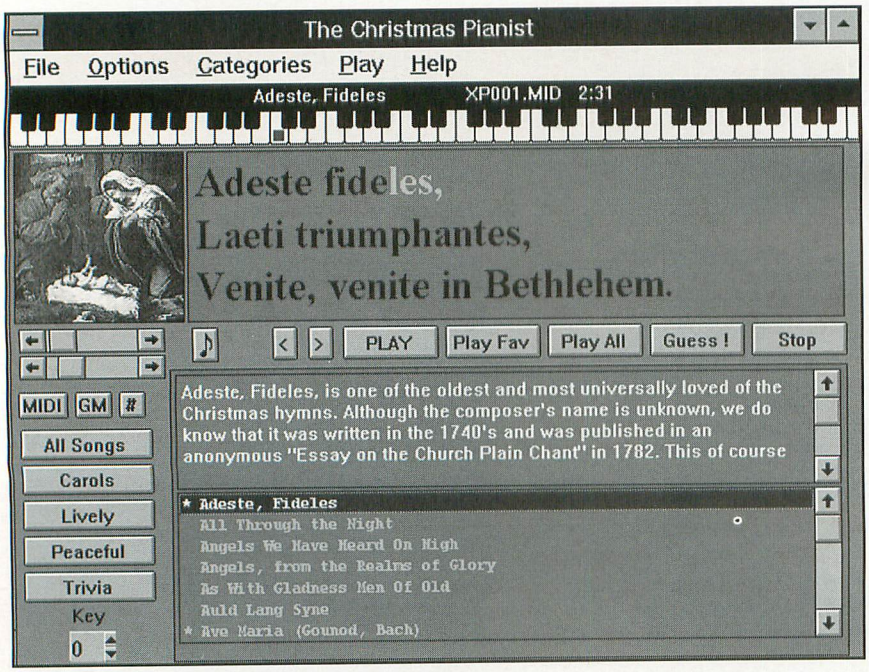
The stand-alone *Jazz Soloist* program from PG Music gives you background on the selection and chord progressions used and shows you the lead line being played on the piano keyboard. Additionally, the files are can be played on with any standard MIDI sequencing package and are also included in *Band-in-a-Box* format.

for this process to work correctly—hearing the solos and seeing and printing the music—and they're all offered together in this program. *Windows* users can see/print the notation in the stand-alone program and from *Band-in-a-Box* as well.

The Christmas Pianist

I realize that by the time you read this, Christmas 1995 will have come and gone, but this is a product that's newsworthy nonetheless and something you might want to get before Christmas 1996 rolls around. *The Christmas Pianist* features great piano performances of more than 50 all-time favorite Christmas songs and carols, for listening or singing along. The lyrics to all songs are displayed on-screen in large type, and you can view or print out the piano arrangements—chords, lyrics and music notation! This makes it easy to learn to play these favorite Christmas pieces yourself.

The selections include "*Adeste Fidelis*," "All Through The Night," "The First Noel," "God Rest Ye Merry Gentlemen," "The Twelve Days of Christmas," "We Wish You A Merry Christmas," "What Child Is This" and many, many more. This program will fill your home with Christmas Cheer anytime, all year long, and it makes an extra-nice stocking stuffer for that musical computer user you may know. ■



The Christmas Pianist from PG Music provides all of the lyrics for more than 50 favorite Christmas songs and carols, as well as background material on the selections. The on-screen piano keyboard is like an electronic player piano that shows the keys being pressed as the notes are played. It's a great program for listening, singing along or learning the songs yourself.

Products Mentioned

Neato CD Labeler Kit, $79.95
MicroPatent
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Band-in-a-Box Styles Disk #6, $29; *Band-in-a-Box* Styles Disk#6 and #7,$29 each; *The Jazz Soloist* Volumes 1 and 2, $49 each; *The Christmas Pianist, $49*
PG Music Inc.
266 Elmwood Ave, Ste. 111
Buffalo, NY 14222
Tel.: 800-268-6272

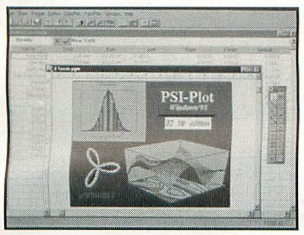
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thumbnails replace the generic operating system icons. *Hi-Jaak* also creates an image database that lets you search for images visually, by file-name, location, keyword, attribute, file size or date. *Hijaak* is designed to take full advantage of the new features in *Windows 95*, including OLE 2.0, 32-bit architecture and multitasking. *Inset Systems, Inc., 71 Commerce Dr., Brookfield, CT 06804; tel.: 203-740-2400; fax: 203-775-5634.*

CIRCLE NO. 22 ON FREE CARD

32-Bit *PSI Plot*

The 32-bit edition of *PSI-Plot* for *Windows/Windows 95* is Poly Software's new technical



plotting and data-processing package. The most significant advantage of the 32-bit version is speed—three to five times faster than its 16-bit counterpart. Other new features include improved data-analyzing capabilities, advanced plotting techniques, more user controlled features and exporting to most popular graphics formats. $299. *Poly Software Int'l., PO Box 526368, Salt Lake City, UT 84152; tel.: 801-485-0466; fax: 801-485-0480.*

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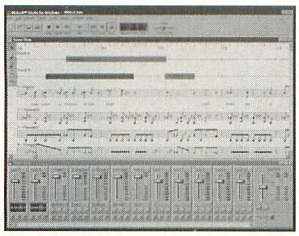
The Troubleshooter Upgrade

AllMicro's *The Troubleshooter* 4.5 is a professional-level operating-system-independent PC diagnostic program. It lets you switch from *The Troubleshooter*'s operating system to DOS when working in that environment is more appropriate to the situation. Highlights of this version include: full testing of Pentium CPUs; full testing of multimedia—CD-ROM, speakers, sound cards; low-level formatting of IDE drives; testing of full external cache memory; I/O-port map; and identification of SCSI devices. $350. *AllMicro, Clearwater, FL; tel.: 813-539-7283.*

CIRCLE NO. 24 ON FREE CARD

Studio for *Windows 95*

Midisoft's *Studio* 4.0 lets you record, edit, arrange and print music that consists of both MIDI and .WAV file tracks.



The new version is *Windows 95*-compliant and features .WAV file recording and editing, the ability to add lyrics to MIDI tracks and a Piano Roll view. $199.95. *Midisoft Corp., PO Box 1000, Bellevue, WA 98009; tel.: 206-391-3610; fax: 206-391-3422.*

CIRCLE NO. 25 ON FREE CARD

Handwritten Fonts

ClickArt Handwritten Fonts from T/Maker on CD-ROM contains 300 fonts that were crafted using actual handwriting samples. The fonts are in TrueType format, assuring compatibility with any computer and printer. Included is a special offer to turn a user's handwriting into his or her own personal font. *T/Maker Co., 1390 Villa St., Mountain View, CA 94041; tel.: 415-962-0195; fax: 415-962-0201.*

CIRCLE NO. 26 ON FREE CARD

CoSession Upgrade

CoSession for Windows 6.0 from Triton Technologies is a remote communications software package that permits a PC in one location to remotely operate or access a second PC via modem, serial port or network connections. This version performs significantly faster that previous versions and now has the ability to connect PCs running *Windows 95* and other *Windows* and DOS versions. Version 6.0 also adds support for Winsocket connections.

Enhanced file-transfer capabilities include "intelligent" file transfer that updates only portions of files that have changed. File synchronization and cloning have been added to provide greater flexibility for handling file-management tasks between two computers. The package includes software for two PCs. $80. *Triton Technologies, Inc., 200 Middlesex Tpke., Iselin, NJ 08830; tel.: 908-855-9440.*

CIRCLE NO. 27 ON FREE CARD

CAD Upgrade

SuperCAD and *SuperPCB* for *Windows* from Mental Automation are schematic-editor and printed-circuit-board layout programs, respectively. Each program has been upgraded with the following new features: moveable reference designators, rotation to 1° accuracy, rotation by dragging, vertical flip capability and a parts bin for holding common parts. $149/$499, *CAD/PCB. Mental Automation, 5415 136 Place S.E., Bellevue, WA 98006; tel.: 206-641-2141.*

CIRCLE NO. 28 ON FREE CARD

OCR for *Windows*

Recognita Plus 3.0 is the latest version of Recognita's optical-character-recognition software for *Windows*. Some of its new features include compliance with OLE 2.0 and the Multiple Document Interface, an auto corrector, automatic image rotation, support for grayscale scanning and recognition of barcodes, check marks and handwritten numerals.

The program accepts input from more than 140 scanner models, including TWAIN-compliant scanners, from image files in several different formats or directly from other *Windows* applications. $395. *Recognita Corp. of America, Sunnyvale, CA; tel.: 408-241-5772; fax: 408-241-6009.*

CIRCLE NO. 29 ON FREE CARD

BOOKS

Microsoft Windows 95 Resource Kit

(Microsoft Press. Soft cover. 1,348 pages. $49.95 with CD-ROM)

This massive book is organized into eight parts. Part 1, an overview for MIS managers and technical-support people for testing and deploying *Win95* on a corporate net-work. Part 2 details in-stalling *Win95* on multiple computers and gives information on creating custom installations and installing *Win95* from setup scripts. Part 3 describes how to install and configure *Win95* on different networks and provides information on installing it to run with a real-mode network client from other network vendors.

Part 4 discusses system-management features provided with *Win95*—system policies, management tools and remote administration capabilities. Part 5 details how to install and troubleshoot devices, configure and run applications and set up and manage printers.

Part 6 covers communications features in *Win95*, with details on configuring and using modems and related software and setting up and using Microsoft Exchange and Microsoft Fax. Part 7 provides technical details about *Win95* architecture and Registry. It covers troubleshooting *Win95*.

Part 8's appendices provide a glossary and a summary of commands you can use at the command prompt and in batch files; details for creating custom setup scripts; configuring the network; using shortcuts and accessibility features; and more.

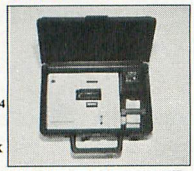
The included CD-ROM offers a variety of utilities for enhancing and tuning up *Win95*. This book/CD-ROM package is a "must-have" if you want to become a *Windows 95* power user.

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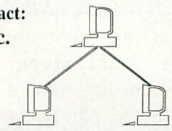
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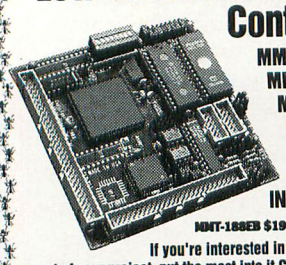
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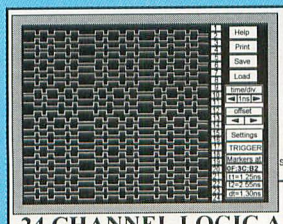
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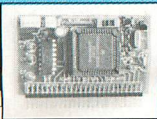
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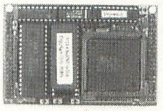
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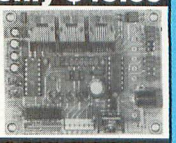
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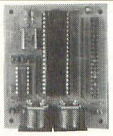
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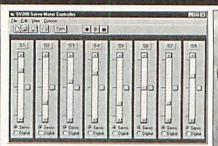
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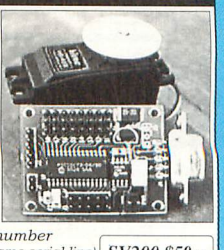
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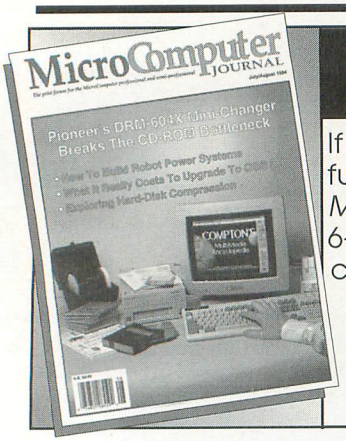
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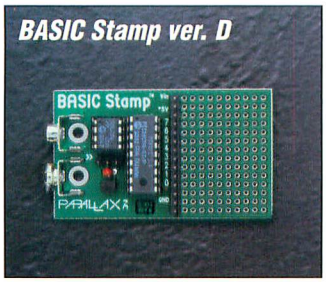
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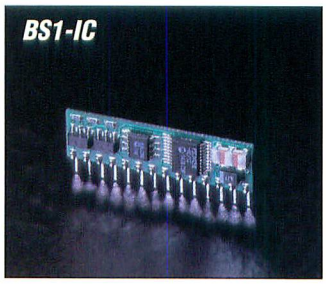
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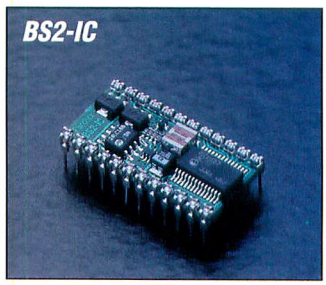
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Stamps come in three forms. Version D has battery clips and a prototype area, making it perfect for small projects. The BS1 and BS2 come in standard SIP and DIP packages, making them perfect for small production runs or for use where space is limited.







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Programming Interface	Parallel	Parallel	Serial
Prototype Area	Built-in	Optional carrier board	Optional carrier board
I/O Instructions	BUTTON, HIGH, INPUT, LOW, OUTPUT, POT, PULSIN, PULSOUT, PWM, REVERSE, SERIN, SEROUT, SOUND, TOGGLE	BUTTON, HIGH, INPUT, LOW, OUTPUT, POT, PULSIN, PULSOUT, PWM, REVERSE, SERIN, SEROUT, SOUND, TOGGLE	BUTTON, COUNT, DTMFOUT, FREQOUT, HIGH, INPUT, LOW, OUTPUT, PULSIN, PULSOUT, PWM, RCTIME, REVERSE, SERIN, SEROUT, SHIFTIN, SHIFTOUT, TOGGLE, XOUT

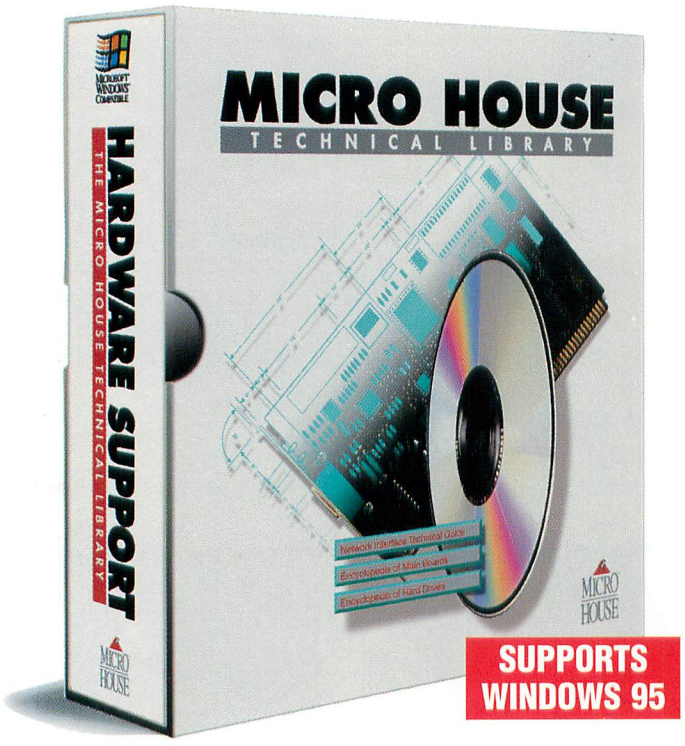
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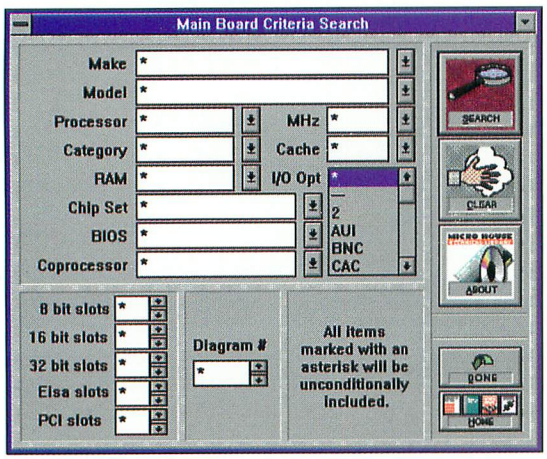
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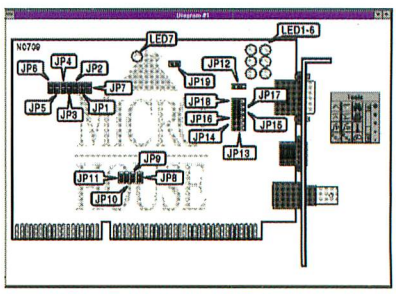
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